FIRST-QUARTER CRITICALITY SAFETY PROGRAM REVIEW AT THE OAK RIDGE Y-12 PLANT

SEPTEMBER 1998

U.S. DEPARTMENT OF ENERGY

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The Y-12 Site Office Criticality Safety Program Review

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DEFINITIONS

Strength

A strength is a program element or activity that represents industry best practice or equivalent.

Weakness

A weakness is a program element or activity that complies overall with applicable Orders and standards, but has specific attributes that are sub-optimal relative to best practices. The YSO Criticality Safety Program Manager informally tracks corrective actions for weaknesses.

Deficiency

A deficiency is a program element or activity that does not comply with applicable Orders and standards. YSO requires formal corrective action plans from LMES for Deficiencies and formally closes out all required tasks.

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EXECUTIVE SUMMARY

The purpose of this review is to support the Department of Energy's Y-12 Site Office (DOE YSO) first quarter FY99 review of the criticality safety program at the Oak Ridge Y-12 plant. YSO management has two primary objectives in performing this limited review. First, the team reviewed criticality safety evaluations to ensure the program meets the requirements of ANSI/ANS-8.19, *Administrative Practices for Nuclear Criticality Safety*, as well as related ANSI/ANS-8 series standards. Second, the team examined the criticality safety program in Building 9206. The criticality safety of the processes in Building 9206 were examined in light of requirements extracted from ANSI/ANS-8.1, *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors.*

The Team conducted its onsite review September 28 – October 2, 1998. During the site review the Team toured Buildings 9212, 9215 (M & O Wings), 9204-4, 9204-2E (B2E), 9720-5 (Warehouse), and 9206. The Team reviewed operating procedures, program descriptions, criticality safety evaluations (CSEs) and approvals (CSAs), limits, postings, and criticality safety requirements (CSRs). Finally, the Team interviewed Sr. LMES Management, Operations Managers, Shift Technical Advisors, Process Engineering Management and Staff, and the Nuclear Criticality Safety Organization (NCSO) Management and Staff.

The Team identified 7 Strengths, 3 Weaknesses, and 4 Deficiencies. The Team developed four formal recommendations corresponding to each Deficiency. Where weaknesses were noted, the Team provided suggestions within the body of the text in this report. YSO tracks corrective actions for Weaknesses informally through weekly meetings between the YSO Criticality Safety Program Manager and the LMES NCSO Manager. YSO requires formal corrective action plans from LMES for all Deficiencies and formally closes the tasks in the corrective action plans.

Y-12 has made considerable progress in moving toward formal operations, notably with the inclusion of explicit criticality safety controls in operating procedures for both Enriched Uranium Operations (EUO) and Disassembly and Storage Organization (DSO). The Team identified an outstanding example of a Process Description (PD)-Criticality Safety Evaluation (CSE)-Criticality Safety Requirements (CSR) set supporting EUO. This product demonstrates the procedures in place for EUO promote development of CSEs meeting the expectation of ANSI/ANS Standards. The Nuclear Criticality Safety Organization utilizes procedures implementing prior recommendations regarding the format of CSEs developed for EUO.

The Team reviewed the *1998 Annual Review of the Y-12 Criticality Safety Program* (Y/DW-1741), focused on DSO. Based upon the Team's review of DSO, the Team concurs with all the findings, issues, noteworthy practices, and recommendations in the report. DSO operations are conducted safely from a criticality safety standpoint. In particular, the recommendation to upgrade the DSO CSEs should be undertaken as planned. The end product of the effort should be CSEs that document the complete criticality safety basis without referencing other documents. The CSE upgrade program for DSO will ensure continued criticality safety of operations independent of the availability of senior nuclear criticality safety staff with historical knowledge of the processes, CSAs, and controls.

The Team believes that improvements are needed in the process that generates the criticality safety basis in order to proceed with aqueous processing operations. These improvements are: 1) the creation of more complete process descriptions for the criticality safety evaluations, 2) assuring the involvement of supervisory operations personnel in the generation of the criticality safety parameters and limits to be controlled, and 3) modifying the criticality safety evaluation peer review process to ensure that the reviewers impose proper expectations. Currently, Y-12 NCSO relies heavily on the process knowledge of key criticality safety personnel, many of whom are near retirement. Absent these improvements in the safety documentation, the team believes that criticality safety will be vulnerable to minor plant modifications or process changes that would change the existing practices or process streams of material. Therefore, future operations could create undue risk in the absence of the improved documentation. Every operation restarted during Phase B should be supported by a stand-alone, fully documented criticality safety evaluation amenable to independent review and verification without resort to interviews of NCS staff.

The Team found that most EUO CSEs do not contain a description of the fissile process and that the configuration of the facility is not documented. Criticality safety depends upon knowledge of the fissile material processes and systems. The Team noted that a PD complete with hardware description, process interfaces, and isolation points supported the finest example of an EUO CSE. For Phase B operations and all revised or modified operations, Operations must define the fissile processes, capture the as-built configuration of the systems, identify interfaces and boundaries, determine and verify isolation points, and describe process upsets important to criticality safety in the PD. The PD should then be explicitly incorporated in the CSE.

The Team found that Y-12 Operations does not formally participate in the development of CSEs and that Operations Supervisors are not familiar with the CSEs and the assumptions and contingencies contained in them. The absence of Operations involvement in the development of CSEs has led to the production of criticality controls that are cumbersome for Operations. Therefore, the CSRs communicating the controls to Operations typically undergo multiple revisions as Operations iterates to develop a practical set of controls. Operations continuously changes the personnel interacting with NCSO and these personnel lack knowledge of the process. Operations' knowledge of the contingencies and assumptions in the CSEs is essential to ensure that plant configuration changes do not degrade criticality safety. The Team recommends that Y-12 Management ensures that Operations (i.e. the subject matter expert (SME), Process and System Engineers, EUO Restart and EUO Operations) team with NCSO to develop PDs and CSEs/CSRs. The Operations-NCSO team should work together on the CSE to identify contingencies and develop controls for those contingencies that are acceptable to Operations. To avoid the problem of multiple revisions to recently issued CSRs, Operations should identify SMEs (i.e. experienced operators that ran the processes and are authorized to identify and accept criticality controls) to be part of the CSE/CSR development team. Finally, Operations Management should read, understand, and concur on all CSEs.

The Team noted wide variation in the quality of the nine CSR/CSEs that were reviewed by the Team. This variation is due, in part, to changing DOE expectations concerning the graded approach to criticality safety for the various phases of EUO restart. The Team found one CSE that established a self-contained, detailed safety basis that permits independent peer review as required by ANSI/ANS-8.19. The Team interviewed the analyst and the peer reviewer, if available, for most of the CSEs and an NCSO management representative concerning lack of limits and other requirements in several CSEs. Through this process the Team concluded that although deficiencies exist in the CSE documentation, the criticality safety of restarted EUO and DSO metal operations is not jeopardized. The criticality safety of the metal processes restarted to date rely primarily on mass control and control of individual items. The parameters on these dry processes are easier to control than solution concentration, volume and transport for the Phase B aqueous processes. The metal and oxide operations are controlled by Nuclear Materials Safeguards Accountability requirements that are not explicitly credited in the CSEs but that impose substantial restrictions providing NCS benefit. Finally, metal and oxide operations pose less criticality safety risk than aqueous processing as evidenced by the history of criticality accidents.

The Team reviewed the criticality safety program of Building 9206. The Team found that the addition of a full-time criticality safety engineer in the facility is a positive development. Very little work is going on now in Building 9206. Deactivation activities have been planned and are dependent upon obtaining funding and restart of the Phase B processes in Building 9212. Deactivation activities will require three to four full-time CEs. The few evolutions that do occur in the facility receive criticality safety review. The Team noted one weakness in the criticality safety program related to the fact that new, approved postings are not visibly distinguishable from old, invalid criticality safety postings. The criticality safety risks in Building 9206 remain unchanged from those identified in the High Enriched Uranium Vulnerability Report.

Deficiencies, Strengths, and Weaknesses	
Deficiency	The Operations SMEs and supervisors are not familiar with CSEs, and do not effectively participate in the development of the CSEs.
Deficiency	Operations does not demonstrate responsibility for using engineered, rather than administrative, controls whenever feasible in glovebox operations.
Deficiency	The Team found that process descriptions are not developed.
Deficiency	While the Team notes the progress Y-12 has made towards a standards-based EUO CSE approach since 1994, the Team found wide variability in the completeness and rigor of the documented criticality safety basis in the CSEs. The NCSO CSE process does not ensure that limits on controlled parameters and assumptions are documented and that all contingencies are explicitly dispositioned in stand-alone CSEs. This will result in a degradation of criticality safety over time due incomplete knowledge of the process, assumptions, controls, and contingencies.
Weakness	The Team observed some criticality safety postings in EUO that were difficult to read by operators from normal work locations, contained misleading information, and were not protected from disfigurement.
Weakness	Many criticality safety postings for storage arrays in EUO rely upon operator knowledge of non-process-specific container loading procedures; conformance with the CSR cannot be ascertained by inspection of containers and postings alone.
Weakness	The Building 9206 active and inactive criticality safety postings are not visibly distinguishable from each other.
Strength	The Team found that the Y-12 Plant management and organization reflected a strong commitment to nuclear criticality safety. The Team believes establishing the Technical Support Organization to provide process/system engineer support should further enhance a cooperative working relationship between NCSO and EUO.
Strength	The Team found that the EUO Configuration Management - Change Control Process requires appropriate NCS reviews.
Strength	The Team found that the inclusion of criticality safety controls and limits in operating procedures is a program strength at Y-12.
Strength	The Y-12 procedures dealing with NCS Incidents, Deficiencies, and Procedural Noncompliances are a program strength, and permit management to grade the response to these abnormal situations, while still capturing lessons learned and tracking and trending all the identified deficiencies.
Strength	The Y-12 NCSO training and qualification procedure for criticality safety staff is a program strength. This procedure identifies specific NCSO job tasks, and utilizes oral boards and interviews with mentors to verify competency.
Strength	NCSO staff makes use of critical mass data and ANSI/ANS limits as appropriate, in lieu of complex Monte Carlo calculations.
Strength	NCSO assigns Lead Criticality Engineers for each facility or process area, thereby improving NCSO knowledge of operations and improving the NCS involvement with day-to-day Y-12 operations.

INTRODUCTION

The purpose of this review is to support the Department of Energy's Y-12 Site Office first-quarter FY99 review of the criticality safety program at the Oak Ridge Y-12 plant. YSO management has two primary objectives in performing this limited review. First, the Team reviewed criticality safety evaluations to ensure the program meets the requirements of ANSI/ANS-8.19, *Administrative Practices for Nuclear Criticality Safety*, as well as related ANSI/ANS-8 series standards. Second, the Team examined the criticality safety of operations in Building 9206 to ensure that safety is not degrading in this uranium storage and processing facility during the prolonged curtailment of operations. The safety of the processes in Building 9206 were examined in light of requirements extracted from ANSI/ANS-8.1, *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors.*

The Team conducted its onsite review September 28 – October 2, 1998. During the site review, the Team toured Buildings 9212, 9215 (M & O Wings), 9204-4, 9204-2E (B2E), 9720-5 (Warehouse), and 9206. The Team reviewed operating procedures, program descriptions, CSEs, CSAs, limits, postings, and CSRs. The Team interviewed senior LMES Management, Operations Managers, Shift Technical Advisors, Process Engineering Management and Staff, and NCSO Management and Staff. Finally, the Team documented issues on Forms 1, and received contractor responses on Forms 2 (see Appendix A).

BACKGROUND

Fissile material operations at the Y-12 plant are being restarted in phases after curtailment in 1994. Uranium processes such as shipping, inspection, assembly, disassembly, casting, and machining have been restarted. Operations remaining to be restarted involve uranium recovery and aqueous processing. The criticality safety program has changed during each phase of restart in accordance with DOE-approved restart plans with the goal of eventually meeting the requirements of the ANSI/ANS-8 Standards. This phased approach has resulted in different levels of compliance with the standards, and hence, different criticality safety programs for each of the major process areas, depending upon when the operation restarted. The primary purpose of this limited review is to ensure that the Y-12 criticality safety program is on the proper path toward meeting the safety requirements of the ANSI/ANS Standards, especially for the relatively higher-risk solution processing operations expected to resume in FY99 known as Phase B. An important aspect of this review is to examine the disparities in the criticality safety practices applied to the different phases of operation and to assess the safety significance of these diverse practices.

The secondary priority for this review is to provide feedback on the criticality safety program in Building 9206. Building 9206 contains enriched uranium, compounds, and solutions. Fissile material processing activities in this facility have been curtailed since 1994, and will not resume. Deactivation plans have been developed. During this prolonged stand-down, the facility criticality safety program has received little attention.

DOE YSO management requested the support of the Office of Nuclear and Facility Safety, EH-3, in performing this limited quarterly review to provide an independent perspective by respected criticality safety professionals. This review encompassed the elements of the criticality safety program dealing with double contingency and the criticality safety evaluations at Y-12. The applicable DOE Order at Y-12 for criticality safety is 5480.24. DOE O 420.1, which replaced the older Order, has not been incorporated into contracts with LMES, which operates Y-12. DOE Order 5480.24 mandates compliance with certain ANSI/ANS Standards for criticality safety, including ANSI/ANS-8.1 and ANSI/ANS-8.19. LMES has developed Standards/Requirements Identification Documents (SRIDs) for each of the specific requirements in the mandatory standards. This report identifies specific SRIDs covered by the Team during its review. The review areas were drawn from the mandatory Standards, ANSI/ANS-8.1, *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*, and ANSI/ANS-8.19, *Administrative Practices for Nuclear Criticality Safety*, as documented in the Team's Review Plan (Appendix B).

The Team identified strengths, weaknesses, and deficiencies. Formal stand-alone recommendations were developed for each deficiency, and are highlighted in the report. Where weaknesses were noted, the Team provided suggestions within the body of the text.

TECHNICAL REVIEW RESULTS

1.0 Supervisory Responsibilities

Evaluation Criteria for Supervisory Responsibilities

Supervisors of the Criticality Safety Program:

- Accept responsibility for the safety of operations under their control (SRID 5329)
- Are knowledgeable in the aspects of criticality safety relevant to operations under their control (SRID 5330)
- Develop or participate in development of procedures applicable to operations under their control and maintain these procedures to reflect changes in operations (SRID 5332)
- Verify compliance with criticality safety specifications for new or modified equipment before its use (SRID 5333)
- Require conformance with good safety practices, including labeling of fissile materials and good housekeeping (SRID 5411)

Introduction

The objective of this element is to ensure that supervisors within the Operations organizations accept the responsibility for NCS requirements related to their operations. This includes participating in the development and implementation of NCS requirements related to operations under their control. ANSI/ANS-8.19 Section 5.0 outlines the supervisor's responsibilities related to NCS.

Three deficiencies were identified within the category of Supervisory Responsibilities. These deal with Operations participation in the development of the CSEs, absence of PDs, and the preference for administrative controls (primarily spacing) instead of engineered controls. Phase B operations will involve restart of aqueous recovery processes. The hardware systems and chemical processes are complex in Building 9212. History has shown that solution processing involves the greatest risk of criticality accidents. Criticality safety during Phase B requires involving operations process experts in the CSE process, developing PDs that capture the as-built configuration of the facility, and establishing physical controls where feasible.

Y-12 plant management is committed to NCS, and is aware of its importance. The Team identified two strengths related to the Technical Support Organization and to the Configuration Change Control Process. The advent of the Technical Support Organization and it's commitment to producing PDs should markedly improve the documented safety basis of the Phase B operations. The previous experience of the Manager, Technical Support, as Operations Manager of 9212 should further enhance a cooperative working relationship between the NCSO, EUO, and the Technical Support Organization. The configuration change control procedure requires NCSO review of all engineering and maintenance work packages.

Detailed discussion of the results of the Team's review pertaining to Supervisor Responsibilities follow.

Strength

The Team found that the Y-12 Plant management and organization reflected a strong commitment to nuclear criticality safety. The Team believes establishing the Technical Support Organization to provide process/system engineer support should further enhance a cooperative working relationship between NCSO and EUO.

The NCSO Manager reports directly to the Y-12 Plant Manager. This direct line of reporting should ensure that NCS awareness is maintained at the highest level of management. This reflects the LMES commitment to criticality safety. This is a significant improvement over the NCS difficulties iterated in the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 94-4, "Deficiencies in Criticality Safety at the Oak Ridge Y-12 Plant." Personnel staffing and issue expediting should benefit from the management structure. This organizational structure is consistent with the ANSI/ANS-8.19 requirements. The Standard requires an intact NCSO organization independent of operations. It is a good practice to have NCSO report at a high level within LMES as is currently done.

The Team considered the establishment of the Technical Support Organization with Lisa Loden, Manager, reporting directly to the EUO Deputy Manager, to be a positive organizational decision. Within the Technical Support Organization reside the process/system engineers, technical specialists, configuration management, equipment design, and procedures groups. Central management of all the technical support needed for operations and criticality eliminates many of the organizational difficulties often encountered between multiple organizations. Many positive comments were received during interviews and walkdowns of the EUO facilities. The previous experience of the Manager, Technical Support, as Manager of EUO should further enhance a cooperative working relationship between the Nuclear Criticality Safety Organization, EUO, and the Technical Support Organization.

Strength

The Team found that the EUO Configuration Management - Change Control Process requires appropriate NCS reviews.

The Team was impressed with the EUO Configuration Management Change Control Process (CCP). The Team reviewed the program and procedures and interviewed

Operations Management, Shift Technical Advisors, Process Engineers, and NCS staff regarding the change control process. Configuration changes are initiated with a Change Request (CR) Form. This form contains the necessary Unreviewed Safety Question Determination (USQD) screening questions and a section specifically dealing with criticality safety. Section 5 of the CR is filled out and signed by an NCSO representative. While the as-built configuration of the facility has not been uniformly and systematically documented, changes to the facility receive proper review. In addition, the Team found that EUO issued a standing order to ensure that NCSO reviews maintenance work packages. The standing order is a compensatory measure put in place after NCSO concerns were presented to the 9212 OSB. This is a recent change to the CCP, initiated by NCSO through the Operational Safety Board (OSB). The Team believes review of maintenance work packages is crucial to ensuring criticality safety of operations at Y-12 because of the role that unreviewed and unapproved maintenance operations have played in past process criticality accidents.

The documentation of criticality safety controls in procedures was fairly comprehensive in both EUO and DSO. Changes to procedures require NCSO approval to ensure no criticality safety issue has changed. Walkdowns of the procedures with SME, operations, and criticality safety engineers is a positive mechanism to ensure all parties are in agreement and concur with the changes which have been instituted. In addition, the EUO safety basis group maintains a database to cross-reference CSRs and procedures.

The Team did not review the document control system in detail. The Team noted, during discussions with the NCSO staff, that each CSA/CSR has a similarly numbered CSE. Revisions to CSE are numbered, and subject to document control. The Team was informed that the CSA/CSR/CSE documents are controlled by NCSO. The NCSO Compliance organization also keeps a listing of approved documents. The listing was provided to the Team.

Deficiency

The Operations SMEs and supervisors are not familiar with CSEs, and do not effectively participate in the development of the CSEs.

The Team found that the current mode of CSE development does not include the SME or operations supervisors. Once a CSE is developed, it is retained by the NCSO and not shared with operations. EUO issued a standing order to ensure that NCSO reviews maintenance work packages. The standing order is a compensatory measure put in place after NCSO concerns were presented to the 9212 OSB. This leaves the operations personnel at a loss as to the assumptions and contingencies contained in the CSE. The Team found that CSEs produced for EUO restart to date are not read by line supervision. The Team does not believe that line supervision could understand the CSEs even if they did read them (see discussion in Section 3). The Team did discuss these issues with the plant staff, and plans are ongoing to place process descriptions in the Phase B CSEs (see discussion below). Senior managers reported to the Team that NCSO continues to place more restrictions on their operations during the development of CSRs. The Team finds that, without involvement in the CSE process, the bases for the limits and controls cannot be well known by Operations Management, and efficient controls will not be developed.

In discussions with EUO management and with NCSO management and staff, it was clear that the system of involving operations in developing the CSEs is informal and ad-hoc. The division of Operations into EUO Restart, EUO Operations, and Technical Support, each with a different view of the process/system, is not conducive to providing authoritative, consistent technical input to the CSE/CSR development process. The extensive rework of Phase A CSRs, discussed briefly below, is a symptom of the absence of authoritative, dedicated operations SME participation in developing CSEs/CSRs. The Team defines an operations SME as one who has been personally involved in running the process, has a thorough understanding of the system/process, can identify credible process upsets, and is authorized to work with NCSO to develop and accept criticality controls on behalf of supervision.

The Team confirmed that there is a great deal of re-work of CSRs in EUO. The Team found that the general absence of Operations SME involvement in describing the process and developing contingencies contributes to the excessive number of revisions to CSRs. The ad-hoc nature of the current process of obtaining operations input produces deficient CSRs because different personnel on different days with differing perspectives interact with the NCSO staff developing the CSE. Operations validates the CSRs after the CSE has been developed, usually under the duress of schedule pressure.

The Team discussed the process for implementing a CSR with LMES staff, and found that the process is as described in Y70-68-001, *Criticality Safety Requirements Development, Review, and Approval.* The NCSO analyst and the Operations SME walk down the process prior to developing the draft CSR. Next, the draft CSE/CSR is prepared, reviewed, and then given to Operations. This may cause the CSE/CSR to be revised, reviewed, and given to Operations again. The CSE/CSR is then approved by NCSO management.

In phase with the NCSO activities, Operations drafts the procedure or revises an existing procedure as necessary to incorporate all requirements of the CSR. The procedure is reviewed by NCSO to ensure that all requirements of the CSR are incorporated without any change in the meaning of the limits and controls. In practice, Operations often transfers the words in the CSR directly into the procedure. Each requirement from the CSR is identified in the procedure as coming from the CSR.

Recommendation 1

Identify SMEs that have personally operated processes, have a thorough understanding of the system/process, are capable of identifying credible process upsets important to criticality safety, and who are authorized to work with NCSO to develop and accept criticality controls on behalf of supervision. Require SMEs and Technical Support personnel to team with the NCS engineers in developing CSEs to describe the process, develop assumptions, and identify contingencies and appropriate controls that are understood and accepted by Operations. Operations should formally accept CSEs by signing them. Make the CSEs or appropriate sections from them available to line supervision. Rocky Flats provides sections 1-9 (See DOE-STD-3007-93) to operations.

Deficiency

Operations does not demonstrate responsibility for using engineered, rather than administrative, controls whenever feasible in glovebox operations.

The Team found that disposition of contingencies is left to the NCSO staff without input from Operations or Process Engineering. Operations and Engineering are involved only if the controls are too restrictive or unusable. Operations does not demonstrate responsibility for using engineered, rather than administrative, controls whenever feasible. The CSRs in place for EUO still rely heavily upon administrative spacing controls rather than engineered features. A common CSR requirement is to maintain twelve-inch spacing between containers in gloveboxes. Violation of administrative spacing controls is not an unlikely event. The Team observed that many engineered controls are in use as a result of previous engineering and safety analysis efforts to control interaction between safe bottles, items on carts, and to maintain subcriticality in tanks and containers.

The Team determined that walkdowns are performed to ensure that all engineered features are in place prior to starting operations. NCSO and Operations perform the multiple walkdowns. Many of the engineered features requirements identified by NCSO are performance-based; e.g., overflow holes are required so that liquid levels will not exceed a specified height. However, the size and number of the holes are not specified, nor are the inflow and outflow rates for the liquid. This makes the adequacy of the engineered feature difficult to validate for manufacture or when holes are partially blocked. For example, overflow holes are required to maintain safe slab geometry in many hoods. Operations is required to determine the size and number of such holes. The NCSO Manager informed the Team that this aspect of verifying the adequacy of engineered features is currently being reviewed.

Recommendation 2

Operations SMEs and supervision should work with NCSO to remove administrative spacing requirements from glovebox CSRs through the use of engineered controls or by modifying the fissile process. The presence and functionality of all credited engineered controls must be verified and documented to meet requirements prior to initiating fissile material activities.

Deficiency

The Team found that process descriptions are not developed.

EUO originally planned to develop PDs for all restarted processes. The Team identified an outstanding example of a PD/CSE/CSR combination developed early in the restart effort. The purpose of the PD is to describe the process, identify system interfaces, boundaries, and throughputs, and describe credible abnormal conditions to contribute to the contingency analysis. Development and maintenance of PDs or their equivalent is required by ANSI/ANS-8.19 Sections 5.4 and 5.5.

At some point in Phase A1 restart activities, Operations ceased development of PDs. Because of this, most of the CSEs developed for EUO restart do not contain a system/process description that supports an independent review. In reviewing nine CSEs for Phase A2 restart, the Team noted a wide variation in detail for system descriptions contained in the CSEs. The Team did not see any figures or diagrams in the CSEs. All of the CSEs referenced drawings and specification sheets. In some CSEs, this was the extent of the process descriptions. Simple sketches and material flow diagrams would be useful in understanding the process and the process limits and controls. Peer reviewers may have difficulty understanding the process without such aids.

The Team is convinced that EUO must develop complete PDs for Phase B operations as part of the overall CSE development process. The aqueous processing activities in Building 9212 are the highest-risk activities from a criticality safety standpoint. The process boundary, equipment configuration, controls on the process boundary, and physical and chemical process upsets must be identified to develop a sound criticality safety basis. In the near term, the absence of PDs for Phase B could result in missed critical scenarios and failure to control the contingencies, because the system is not well understood by the CSE development Team. In the longer term, as experienced Operations and NCSO personnel are lost, the ability to understand the fissile process and system and to informally establish necessary criticality controls will vanish.

The Team did not observe any permanent unfavorable geometry containers or vessels in Building 9212. The Team questioned Technical Support staff, Shift Technical Advisors, and NCSO staff about the existence of unfavorable geometry solution vessels. None were identified. However, the Team reviewed a CSE that places controls on the use of 55-gallon drums in reagent makeup because of a credible scenario involving siphoning of fissile solution into this unfavorable geometry container. The procedure covering this operation has an administrative hold placed on it because engineered controls credited for preventing this accident have not been verified. In addition, the Team noted that Building 9212 transfers low-concentration solutions outside the facility to Building 9818 into unfavorable geometry tanks. The Team is concerned about what appears to be a general assumption about the absence of unfavorable geometry vessels.

Recommendation 3

Implement plans to develop PDs for all CSEs for Phase B of EUO restart and DSO operations as needed. The PDs should include as-built engineering drawings of the system, process boundaries, process interfaces, throughputs, schematics, and credible abnormal process conditions.

Recommendation 4

As a separate activity, the Team also recommends that EUO systematically document any unfavorable geometry tanks or vessels (temporary or permanent) within Building 9212 and any interfaces with such vessels outside the facility. Special care is needed to establish criticality controls where unfavorable geometry vessels are utilized and to verify that credited engineered controls are installed and performing their intended function prior to restarting aqueous processing.

2.0 Operating Procedures

Evaluation Criteria for Criticality Safety Procedures

Criticality Safety Procedures:

- – Are organized and presented for convenient use by operators and are free of extraneous material (SRID 5488)
- – Include controls and limits significant to criticality safety of the operation (SRID 5489)
- – Are supplemented and revised as improvements become desirable (SRID 5490)
- – Are reviewed periodically by supervision (SRID 5491)
- – Are reviewed by criticality safety staff before issuance or revision (SRID 5492)
- – Are supplemented by posted criticality safety limits or incorporated in checklists or flow sheets. (SRID 5412)

- Deviations from procedures and unforeseen changes in process conditions affecting criticality safety are documented, reported, and investigated promptly and actions taken to prevent recurrence (SRID 5340)
- Operations are reviewed frequently to ascertain that procedures are followed and that process conditions have not changed so as to affect the criticality safety evaluation (SRID 10293)

Introduction

The objective of this element is to ensure that procedures and postings are effective in communicating the NCS requirements to personnel and that deviations are handled appropriately. The Y-12 operating procedures, supplemented by NCS postings or by the limits and controls that can be manipulated by operators, are intended to control operator actions, so as to keep activities with fissile material within the evaluated safety bases. The procedures are developed by procedure writers and validated by Operations. The CSR limits and controls are incorporated into Y-12 procedures, both in EUO and in DSO. ANSI/ANS-8.19 Section 7.0 outlines the requirements for procedures related to criticality safety.

The Team identified two weaknesses related to EUO Operating Procedures. They deal with: 1) some poor CSR posting practices and 2) with the reliance on operator knowledge of ancillary procedures to conform with storage array CSRs. The majority of EUO postings in Buildings 9212 and 9215 are acceptable, and can be read and understood by operators from their workstation. The glovebox procedures invoke explicit mass references from applicable procedures (mass references come from CSRs), and the associated criticality controls are not ambiguous because of the link to an operating procedure. Such is not the case for storage areas that have no such procedure, which must rely on the posting developed from the CSR.

Three program strengths were identified within the context of Operating Procedures. EUO and DSO have done an excellent job of incorporating CSR/CSA requirements, respectively, into operating procedures. Two procedures within NCSO: the NCS deficiency procedure, and the training/qualification procedure for NCSO staff, represent industry best practices.

Detailed discussion of the results of the Team's review pertaining to Operating Procedures follow.

Strength

The Team found that the inclusion of criticality safety controls and limits in operating procedures is a program strength at Y-12.

The Team reviewed operating procedures and the associated CSRs/CSAs. The complete set of CSR/CSA controls are included in the operating procedures in a front section entitled "Precautions and Limitations." In addition, the CSR/CSA controls are sometimes included in a step-wise fashion at the appropriate point in the task section entitled "Performance Activities." The CSR/CSA controls in the procedure unambiguously refer to the source CSR/CSA. The criticality safety controls and requirements are occasionally paraphrased in the procedure for operator clarity, but the Team observed that the intent of the criticality controls remained unchanged. The Team performed a line-by-line comparison of the CSR/CSA with the associated procedure for several procedures and found a one-to-one match with the intended CSR/CSA controls in the procedures. The procedural steps related to criticality safety are easy to understand, contain no extraneous information, and are convenient to use. The Team concurs with Noteworthy Practice CS-1-2, identified in the 1998 Y-12 Plant Criticality Safety Committee Report (Y/DW-1741).

The Team reviewed the criticality safety postings in DSO (Buildings 9204-4, 9204-2E, and 9720-5). These are large-format, yellow-and-black signs with the distinctive fissile material symbol clearly visible. The Team found the postings to be easy to read and to understand. The postings in DSO complement the procedures well as operator aids. The Team found the postings in the Warehouse (Building 9720-5) acceptable. Warehouse operations are conducted by procedures containing explicit CSA requirements. The Warehouse postings serve as reminders of the applicable CSAs and clearly identify fissile material storage areas as required by ANSI/ANS-8.19.

The Team found that the NCS staff reviews all new or revised procedures. The NCS review is indicated on the front cover of operating procedures and supported by comment forms completed by the NCS reviewer. The NCS staff stated that they review authorization basis documents such as the Safety Analysis Report (SAR), Basis for Interim Operation (BIO), and USQD, configuration control changes, and maintenance work packages. The Team was provided minutes of the OSB meeting that initiated NCSO review of maintenance work packages but the Team did not verify that this practice was implemented.

Active procedures are reviewed at least biennially by Operations, and fissile material activities are reviewed annually by the NCSO staff. The biennial reviews of active procedures is governed by "Technical Procedure Process Control" (Y10-102). The NCSO annual reviews of operations are specified in the document "Nuclear Criticality Safety Program" (Y70-150).

Strength

The Y-12 procedures dealing with NCS Incidents, Deficiencies, and Procedural Noncompliances are a program strength, and permit management to grade the response to these abnormal situations, while still capturing lessons learned and tracking and trending all the identified deficiencies.

Deviations from operating procedures and unforeseen alterations in process conditions that affect nuclear criticality safety are documented, reported to management, and investigated promptly. The Team observed a specific incident involving the implementation of the NCS noncompliance program in Building 9204-4. The Operations Manager discovered the noncompliance, required the Team to distance themselves appropriately from the array, and contacted NCSO. The Operations Manager then followed approved procedures that permit recovery from this level of procedural noncompliance without specific involvement of NCSO. The Operations Manager corrected the procedural noncompliance by moving a plastic bag containing potentially contaminated equipment inside the floor array boundary to comply with the CSA.

The Team found that noncompliances are investigated, tracked, and reported to Management. The NCS staff reviews the noncompliances and categorizes them (Incident, Deficiency, Procedural Noncompliance), and issues written corrective actions to remedy the situation. The Team did not review the process for closing open corrective actions stemming from noncompliances. Responsibilities for responding to noncompliances are covered by procedure Y70-150, *Nuclear Criticality Safety Program*, and Y70-68-003, *Nuclear Criticality Safety Incidents, Deficiencies, and Procedural Noncompliances.*

The NCS noncompliance grading program eliminates the need to perform many USQDs. The noncompliance program determines that level 4 noncompliances do not impact double contingency. Hence, the safety basis is not compromised and no USQD need be performed. Only the noncompliance procedure itself must be screened. For level 3 and higher noncompliances, double contingency is compromised and USQDs should be performed. The number of level 4 noncompliances far exceeds the number of level 3 noncompliances. Nuclear safety resources are not expended performing trivial USQDs on level 4 noncompliances.

Strength

The Y-12 NCSO training and qualification procedure for criticality safety staff is a program strength. This procedure identifies specific NCSO job tasks, and utilizes oral boards and interviews with mentors to verify competency.

The Team found that NCSO has a training and qualification procedure for criticality engineers before the engineers are allowed to work on CSR/CSEs. The Team reviewed the qualification procedure for NCSO, Y/DD-694, Rev. 4, the "Nuclear Criticality Safety Organization List of Qualified Personnel," Y/DD-587, Rev. 35, and questions presented during the oral boards. The Team did not interview criticality safety engineers for the purpose of determining competency relative to the requirements of the training/qualification procedure. The Team found that the qualification procedure properly identifies NCSO tasks and matches the training appropriately to the task. The oral boards and mentor interviews go beyond a simple check sheet of qualification criteria and require the student to answer challenging technical questions. The process is flexible enough to accommodate experienced engineers with outside experience as well as newly graduated engineers. The qualification procedure requires that criticality engineers be familiar with building entry and exit practices, and that they have developed an understanding of facility operations. If a criticality engineer is not active in a facility for an extended period of time, the engineer must requalify for the facility before working on CSEs for the facility.

Weakness

The Team observed some criticality safety postings in EUO that were difficult to read by operators from normal work locations, contained misleading information, and were not protected from disfigurement.

The Team toured EUO Buildings 9212 and 9215 and examined the criticality safety postings in the areas. The Team found several criticality safety postings that are difficult to read. In one case, the posting on a glovebox in 9212 is located around a corner on the side away from the workstation at approximately two feet off the floor. There is no workstation where the posting is attached to the glovebox. The operator at the workstation cannot physically see the posting. The Team also found several postings for floor arrays taped to the floor becoming scuffed and torn by foot traffic. These floor postings are easy to miss, and get torn and dirty from activity in the area to the extent that they are difficult to read. In Building 9215 M wing, a chip can dolly was posted as a "potential NCSO noncompliance." The Team confirmed that the chip can dolly was identified as a noncompliance because of improperly functioning clamps holding the lids on the containers. However, the sign indicating that it was a "potential" noncompliance remained posted after the determination that the noncompliance had occurred. This could mislead operators into believing there was uncertainty about the condition of the dolly. Criticality safety postings should be easy to read and understand, clearly visible, and protected from disfigurement.

Weakness

Many criticality safety postings for storage arrays in EUO rely upon operator knowledge of non-process-specific container loading procedures; conformance with the CSR cannot be ascertained by inspection of containers and postings alone.

CSR-STOR-C-037 is used for containers throughout EUO. There is an analog CSA and procedure in DSO. This CSR provides postings to permit storage of a host of approved containers. The document that specifies container dimensions and criticality limits on the containers for general use is Y/MA-7270. CSR-STOR-C-037 refers to Y/MA-7270. The postings rely upon operator knowledge of Y/MA-7270 to properly load the containers. Compounding the difficulty in determining conformance with the posting is a procedure (Y70-37-103) that defines "allowable exceptions" to Y/MA-7270. Therefore, the operator must read the posting for explicit restrictions and limitations that differ from Y/MA-7270 (e.g., a 2-kg limit on green salt cans), must know the allowed container limits in Y/MA-7270, and must know the allowable exceptions in yet another procedure (Y70-37-103). The Team inspected an array of 55-gallon drums that did not fit within the boundaries of the floor partitions. The Team could not confirm compliance with the posting by inspecting the array, reading the posting, and determining the drum contents. NCSO staff accompanying the inspection assured the Team that the array was in conformance with the limits and the "allowable exceptions." ANSI/ANS-8.19 Section 7.1 requires that "procedures should be organized and presented for convenient use by operators." The Team concurs with concern CS-3-2 in the 1998 Y-12 Plant Criticality Safety Committee report (Y/DW-1741), and suggests that the corrective action include steps to clarify postings for container storage to make them stand-alone documents.

3.0 Process Evaluation for Nuclear Criticality Safety

Evaluation Criteria for Process Evaluations

Process Evaluations:

- Demonstrate that the entire process will be subcritical under both normal and credible abnormal conditions (SRID 5357)
- Determine and explicitly identify the controlled parameters and limits upon which safety depends (SRID 5358)
- Are documented in sufficient detail and clarity to allow independent judgment of results (SRID 5342)
- Are independently assessed to confirm the adequacy of the valuation before use (SRID 5343).

Introduction

The objective of this section is to ensure that NCS evaluations developed at Y-12 conform to the expectations of ANSI/ANS-8.1 and 8.19. The limits and postings are communicated to EUO via CSRs and to DSO via CSAs. Both CSRs and CSAs are supported by and derived from CSEs. The CSEs develop controls on parameters necessary to implement double contingency. EUO Operations management initiates the request for a CSR. NCSO management assigns an NCSO engineer and a peer reviewer to develop the CSR/CSE. During the development of the draft documents and after final approval, the process is required to be walked down to ensure that the process is understood, that the limits and requirements are sufficient for nuclear criticality safety, and that the NCS limits and controls can be implemented. During and after implementation, NCSO provides interpretation of CSA/CSR requirements, if requested.

The CSEs for EUO differ from those supporting DSO operations. The CSEs for DSO have not been upgraded to conform to the requirements of ANSI/ANS-8.1 and 8.19 or to DOE-STD-3007-93. CSEs for EUO are developed according to procedures that require conformance to these standards. The original plan for EUO graded restart was not to have the CSEs fully meet ANSI/ANS-8.19 requirements. Current expectations are for Phase B CSEs to be in full compliance with ANSI/ANS-8.19. Earlier criticality safety inspections (i.e. the Task 2 and Task 3 reviews of the NCS program at Y-12) resulted in upgrades to the CSE process for EUO. The procedures governing development of CSEs for EUO represent a marked improvement over the older practices still in place for DSO. The Team found evidence of excellence in the EUO CSE process output but, as discussed below, found a great deal of variability in the quality of CSEs produced in support of Phase A restart activities for EUO. The *1998 Annual Review of the Y-12 Plant Criticality Safety Program* identified the key deficiencies remaining in CSEs supporting DSO and provided appropriate recommendations for improvement. The Team concurs with the findings, observations, and recommendations contained in that report. The Team especially wants to emphasize the importance of implementing the following recommendation from the *1998 Annual Review of the Y-12 Plant Criticality Safety Program* without compromise:

The process analyses underlying the CSAs should be revised (upgraded) to collapse the long chains of references, to document explicitly the assumptions used in the process analysis modeling, to provide the logic chain from underlying assumptions to

the derived controls, and to identify bases for specific requirements.

As stated previously, the Team found that DSO criticality safety controls are well-documented in procedures, and the operations meet expectations of applicable NCS standards and orders. The time and expense of upgrading DSO CSEs is justified only if the resulting end products meet the expectation stated above.

The Team found two findings and one recommendation from previous reviews that are still partially applicable to EUO CSEs. The *1998 Annual Review of the Y-12 Plant Criticality Safety Program* stated that:

Despite the lack of complete documentation, the review of CSA process analyses found no technical inadequacies; however, in several cases it was necessary to interview the analyst who had performed the process analysis or one of the senior NCSO staff with extensive historical knowledge to reach this conclusion.

The Task 2 Review of the Y-12 NCS program found that:

LMES does not explicitly identify limits for controlled parameters in criticality safety analyses. The sample of analyses reviewed contained a discussion of the parameters affecting criticality safety. However, LMES does not bring forward to the appropriate CSAs as requirements the necessary limits and assumptions fundamental to the criticality safety analyses. Furthermore, in order to understand the total set of controls and requirements on a particular operation, the burden is placed solely on the criticality safety engineer to review applicable documents. The documents may include multiple criticality safety analyses and approvals where limits are incorporated by reference to other CSAs and general procedures.

To correct this CSA deficiency, the Task 2 Review recommended that:

The Y-12 criticality safety staff should rely on senior criticality safety engineers (until less senior engineers are trained) to ensure necessary limits and conditions are included in operating procedures and understood by the personnel using these procedures. Review of criticality safety analysis should include specific limits and conditions identified in and supported by the analysis that must be met to ensure criticality safety at the Y-12 Plant. These limits and conditions should be included in applicable CSAs to ensure the system (including analyses, CSAs, and procedures) is properly implemented.

The Team found that this recommendation has been partially implemented for EUO. As discussed elsewhere in this report, limits and controls are included in operating procedures. The EUO CSRs contain the limits and controls developed in the associated CSEs. However, the Team found that many of the CSEs for EUO do not explicitly identify limits for controlled parameters and document assumptions, that they do not meet the expectation stated above for upgraded DSO CSEs, and require interviews of the analyst and senior NCSO staff with extensive historical knowledge to reach the conclusion that no criticality safety concern exists in the facility. The reliance on the senior criticality safety engineers to correct the EUO CSE deficiencies as recommended by the Task 2 Review has not had the intended results.

Deficiency

While the Team notes the progress Y-12 has made towards a standards-based EUO CSE approach since 1994, the Team found wide variability in the completeness and rigor of the documented criticality safety basis in the CSEs. The NCSO CSE process does not ensure that limits on controlled parameters and assumptions are documented and that all contingencies are explicitly dispositioned in stand-alone CSEs. This will result in a degradation of criticality safety over time due incomplete knowledge of the process, assumptions, controls, and contingencies.

The Team noted wide variation in the quality of the nine CSR/CSEs that were reviewed by the Team. The Team found one CSE that established a self-contained, detailed safety basis that permits independent peer review as required by ANSI/ANS-8.19. It is important to note that this CSE had the benefit of a completed PD.

The Team interviewed the analyst and the peer reviewer, if available, for most of the CSEs and an NCSO management representative concerning lack of limits and other requirements in several CSEs. Through this process, the Team concluded that although deficiencies exist in the CSE documentation, the criticality safety of restarted EUO and DSO metal operations is not jeopardized. The criticality safety of the processes restarted to date rely primarily on mass control and control of individual items. The parameters on these dry processes are easier to control than solution concentration, volume and transport for the Phase B aqueous processes. The metal and oxide operations are controlled by Nuclear Materials Safeguards Accountability requirements that are not explicitly credited in the CSEs, but that impose substantial restrictions providing NCS benefit. Finally, metal and oxide operations pose less criticality safety risk than aqueous processing, as evidenced by the history of criticality accidents.

The Team identified one example of an excellent CSE and PD combination. The Precipitator PD (PD-EUO-9212-PRCP, Revision 0, 9/2/97) contains detailed descriptions of the components, lists engineering drawings for the system, lists input and output streams, identifies the system boundaries and interfaces, and lists isolation points. The PD contains an overview of normal and abnormal operations for each stage of the process. The discussion of abnormal conditions could be improved to reflect abnormal process changes in addition to the anticipated process alarms, but the PD represents a very good prototype. The CSE (CSE-PRCP-038, Revision 2, 7/5/98) is a self-contained, stand-alone document amenable to independent judgment of results. It does reference the PD, but this is acceptable given the quality and detail in the PD. The Team noted that even though reference is made to the PD, the CSE still explicitly lists the drawings relied upon and detailed description of the precipitator equipment, including dimensions. The discussion and disposition of contingencies is thorough, self-contained, and free from the need to reference other CSEs and CSAs to understand the analyst's logic. The Evaluation and Results section of the CSE does contain some references to calculations performed in other CSEs, but still pulls forward enough of the discussion, without unnecessary repetition, for the reviewer to conclude the results are reasonable. Finally, the CSE develops explicit limits and controls for the process that are carried forward into the CSR without the need to implicitly assume other procedures or processes control the operation. The CSR postings do not reference other procedures, and contain clear statements of limits on the process. The Team concluded that the PD/CSE/CSR for the Precipitator meets the expectations of ANSI/ANS-8.1 and 8.19 and DOE-STD-3007-93 without the need to interview the analyst or senior NCS personnel with extensive knowledge of the process. This represents the standard of excellence that should be routinely achieved by EUO.

Specific CSE/CSR issues raised by the Team are discussed below. These are the symptoms of the root issue identified by the Team: that is, reliance on NCSO peer reviewer expert judgment to provide explanations after the fact, rather than to document the safety basis in stand-alone CSEs. The Team notes that the written explanations provided by NCSO to elucidate the missing parts of the safety basis did not take more than a few hours each (i.e., all the responses were drafted, revised, and forwarded in less than one working week).

- For CSR-CB-042, the Team found that there are limits on the carbon in the carbon burners, but there are no limits on the amount of enriched uranium in the carbon burner hood or in the carbon burners.

There are no limits on the amount of material in transport to or from the process area. The analyst stated that there is no measurement to determine the enriched uranium in the carbon and that the amount of material in transport is covered by a second CSE. The second CSE (CSR-CMH-012) is not referenced in the Carbon Burner CSE, so that there is no evidence that transport of material into and out of the process area was considered. NCSO responded to these concerns by stating that the safety basis depends on process knowledge of the historical concentrations of uranium in the carbon, crediting a passive engineered feature that prevents large pieces of uranium from being deposited in the carbon cans. None of these controls are documented in the carbon burner CSE. The Team observes that measurement of uranium content after carbon burner processing yields process information, but does not control the fissile mass going into the carbon burner. The Team concludes that, while a safety basis may exist, it is not formally documented in a manner amenable to independent review.

- For CSR-DEC-022, the Team reviewed the documents, and noted that there is no spacing requirement for the array of fissile units stored on the floor awaiting decontamination. Without this requirement, the subcriticality of the storage array can not be assured, because the CSR explicitly permits an infinite array of moderated 100-gram items to be created. The Team's position is that the mass in the array must be controlled to assure subcriticality. This can be achieved with mass controls on individual items or by limiting the size of the array by placing a stacking restriction (e.g., maximum of 4' high) on the array, or by limiting items with visible uranium to a single high stack. NCSO posted the area so that the safety basis could be re-examined when informed of the Team's concerns. The posting was removed within a day, based on the review documented later by NCSO. NCSO maintains that the 100-gram figure is not a loading limit, but a "rough characterization breakpoint used as an action level to separate items." NCSO also stated that it requires "at least 15 separate batches in an extremely compact arrangement, all having very close to the sorting action level of 100 grams, with no significant amounts of structural material (poisons) involved" to approach criticality. The Team found that the CSR does not prevent such an arrangement, nor does it credit the neutron absorbers. Such a hypothetical arrangement of items would not result in a criticality safety deficiency because it is permitted by the CSR, although it might result in a criticality accident. NCSO asserts the safety basis is dependent upon process knowledge that assures the "overall array of items is well-subcritical due to the extremely low mass and density of uranium present" after the items are cleaned prior to placing the items in the array. The CSR does not control the process with explicit limits on controlled parameters, as required by ANSI/ANS-8.19. NCSO plans to revise this CSE "to more clearly show the factors that are relied on for the safety of collected items in storage."

- For CSR-HGF-052, the Team found that the CSE/CSR specifies no limit on the number or spacing of units that can be in the hoods or storage rack. The analyst stated that the storage rack was for empty containers only. The Team noted that this was not described in the process description or in the CSE/CSR. The engineer stated that procedure Y70-37-103, *Containers and Material Handling*, controlled spacing and other limits on the number of containers in the hoods. The Team reviewed Y70-37-103, but could find no safety basis (i.e., specific limits on number of containers, contingency identification/

disposition evaluation, etc.) for activities in the hoods and the storage rack discussed in section for the process description. The Team discussed this CSE with the engineer and an NCSO management representative. The engineer stated that another CSE controlled the spacing of containers. The second CSE was not mentioned in the Phase A restart CSE. NCSO provided a response to the Team stating that "It is the connection to Y70-37-103 that allows the CSE to take credit for interaction control." In addition, it is the position of NCSO that the safety basis is adequately documented based on the CSR, coupled with Y70-37-103 and Y/MA-7270. The Team reviewed CSE-CMH-012 that provides the basis for Y70-37-103, and concluded that reliance on the twelve-inch administrative spacing requirement as a contingency in CSE-CMH-012 does not meet the intent of assuring that unlikely process upsets involving interaction have been considered. In addition, the Team concluded that CSE-CMH-012 does not address process-specific, credible abnormal events related to spacing violations of multiple containers. The Team could not determine that the safety basis for this operation had been documented.

- During discussions with the NCSO staff, the Team identified CSR/CSE-BL-050 as being so vague that the process and basis for the limits and controls could not be determined from the CSR. NCSO management agreed with the Team, and reported later that the CSR was being rewritten.

- The Team reviewed one CSE (CSE-TOP-046) in which contingencies are not dispositioned. The contingencies were well-presented in tabular form, so that the failure to disposition all of the contingencies was quite obvious to even a casual reader.

- The Team observed that enriched uranium-contaminated solid waste is collected in 55-gallon drums. The drums are then stored in one-high planar arrays until they can be inventoried by NDA monitoring. The Team questioned the practice of using unfavorable geometry containers without a mass determination on the contents, and then placing the drums in compact arrays (in effect, an even larger unfavorable geometry container) prior to measuring the individual drums. NCSO responded by stating that CSA18214 credits historical data from 1,393 drums indicating that the average uranium loading is 50 grams, and that none contained more than 350 grams. In addition, various administrative drum loading procedures are credited with establishing double contingency for the storage of unassayed drums in close packed arrays. The Team found that the safety basis is fundamentally based on historical process knowledge for the unassayed combustible storage arrays. The Team did not find any mechanism to control the process or monitor changes to ensure that process conditions continue to match those historically seen. Again, the Team found that too much reliance is placed on adherence to single administrative controls to provide the safety basis. Best practices at other DOE sites would require that each item be scanned with a portable gamma ray detector prior to loading into a drum, or that non-assayed drums be administratively spaced from other fissile material, and not placed in a close-fitting storage array.

- The Team found the following CSR/CSEs do not require both independent sampling and independent analyses to guard against a single departure causing a criticality accident: CSR/CSE-TOP-046, CSR/CSE-AEC-021, and CSR/CSE-NR&HNO3-019. The requirements for procedures in ANSI/ANS-8.1 that have been incorporated by reference into the DOE

Orders state, in part, that "They should be such that no single, inadvertent departure from a procedure can cause a criticality accident."

NCSO responded by stating that, with one exception, independent sample analysis is not required to demonstrate compliance with the double contingency principle. The F-700 Pour-Up Station (CSE-NR&HNO3-019) does rely upon dual sampling as the only control preventing a criticality accident. The analysis for condensate collection relies on process knowledge as the primary control to maintain criticality safety prior to the transfer to the 9818 Tanks and Tankers. The Tri-*n*-Octyl Phosphine Oxide (TOPO) process relies on multiple independent sampling failures as a contingency in addition to sampling. The AEC scrubber (CSE-AEC-021) credits process knowledge derived from prior operation to develop postulated upstream upsets to argue that the uranium concentration in the scrubber solution cannot vary rapidly. The Team notes that these additional controls are not documented in the CSEs, and constitute further examples of reliance upon senior NCS staff with knowledge of process history coupled with the assumption that future EUO operations and their associated upsets will mimic past practices.

Recommendation 5

The Team recommends that the NCSO CSE development process be restructured to ensure that stand-alone CSEs are developed that meet the intent of ANSI/ANS-8.19 Section 8. To that end, the Team recommends the following specific steps be taken.

A. *NCSO Staff should be trained to the expectation that a CSE is a stand-alone document containing sufficient detail, clarity, and lack of ambiguity to allow independent judgment of results. The calculations that justify subcritical limits may be referenced, but the PD, contingencies, disposition of contingencies, limits, and controls must be explicitly documented in the CSE.*

B. *NCSO should provide training and guidance to the designated peer reviewers to ensure that CSEs receive critical review such that the peer reviewers do not read into the CSE their knowledge of the Y-12 system to credit undocumented controls and processes for maintaining double contingency. At a minimum, the guidance should require that the peer reviewer consider the individual unit(s); the array(s) of units; changes in chemical and physical form; movement of all fissile material into, through, and out of the process area, process boundaries, verification of engineered controls, and justification for the use of historical process knowledge.*

C. *Steps to enhance the independence of the peer review process from the development of technical input to the CSE and from the schedule requirements should be taken. NCSO should designate a small number of reviewers largely free from competing tasks that distract them from performing thoughtful, critical peer reviews. NCSO should consider acquiring independent peer review services from their colleagues at the Oak Ridge National Laboratory.*

D. *NCSO should identify senior experienced NCS staff as coaches for the analysts. These staff would be largely free from competing tasks, and would be available to the CSE development team to provide insight into the fissile material process to facilitate development of self-contained CSEs conforming to ANSI/ANS-8.19 Section 8. The Team recognizes that several experienced NCSO staff members are nearing retirement, and should be given the opportunity to coach and mentor the younger NCS staff. This activity should not be viewed as a permanent feature of the NCS program with the ensuing need to designate coaches or mentors that do not possess the depth and breadth of knowledge and experience of some of the existing staff.*

E. *Independent peer review comments on a CSE should be formally documented on comment/resolution sheets. The analyst should be responsible for documenting disposition of the comments, and should not feel compelled to accept peer review comments.*

The NCSO Manager should be responsible for disposition of disagreements between the peer reviewer and analyst. Each CSE should receive only one cycle through the independent peer review step. The Team recommends that NCSO distribute generically applicable peer review comments to the staff via internal communication mechanisms already established.

F. *NCSO should formally justify continued reliance on process knowledge developed from pre-1994 operating history and requirements for independent sampling and analysis for controlled parameters (mass, concentration, etc.) as bases for establishing double contingency. NCSO should communicate revised requirements to the staff, and should task the peer reviewers with ensuring compliance with the revised expectations. For those cases where process knowledge is relied upon, a formal protocol should be developed for determining that conditions do not change in such a way as to invalidate assumptions.*

Strength

NCSO staff makes use of critical mass data and ANSI/ANS limits as appropriate, in lieu of complex Monte Carlo calculations.

The CSEs make use of experimental critical mass data, ANSI/ANS-8 standards limits, and calculation methods that are less complicated than Monte Carlo calculations in some CSEs. The use depends on several factors, including the nature of the process and the type and quantity of material involved in the process. The Team did not observe any undue reliance on Monte Carlo calculations.

Discussion

The Team noted that LMES has procedures for developing and implementing CSA/CSR/CSE for all activities using more than specified quantities in Table 1 of Y70-150, *NUCLEAR CRITICALITY SAFETY PROGRAM*. The Team reviewed documents controlling the development of CSA/CSR/CSE. The procedures reference the DOE Orders and ANSI/ANS-8 standards, and incorporate the intent of the referenced documents.

The Team discussed the availability of old CSEs (developed prior to the 1994 stand-down) with the NCSO staff. The availability of these CSEs varies by building and age of the CSEs. In general, the pre-existing CSEs for Phase A restart processes are available

The Team found, by discussions with the NCSO staff and by reviewing CSEs, that contingencies are considered unlikely events based on the failure of engineered (passive and active) controls or administrative controls. The Team examined nine CSEs that had been developed to support EUO restart. The contingencies, such as double batching and buildup excessive of material in the ductwork, appear to be reasonable as well as unlikely. The Team interviewed several NCSO staff members concerning contingencies. The NCSO analyst develops the contingencies based on old CSE contingencies and informal discussions with SME (often an operator or a former operator who has been promoted to supervisor). The NCSO engineer uses a general "what-if" approach to develop the contingencies. The contingencies are not developed in a formal way with Operations and Process Engineers providing input. Disposition of the contingencies is left to the NCSO because Operations and Process Engineers do not participate in resolution of contingencies and the CSE does not go to Operations (see the discussion in Section 1.0). The safety basis for each LMES fissile activity is left entirely in the hands of the NCSO. The type of control (administrative or engineered) is decided by the NCSO.

The Team found that the format for the CSEs followed the format in the DOE standard DOE-STD-3007-93, *Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Nuclear Facilities*. The CSEs varied in the presentation of the contingency evaluations, but this is allowed by the standard. As discussed elsewhere in this report, the completeness of the CSEs did not satisfy the intent of the standard. Only one of the nine CSEs reviewed by the Team is a stand-alone document amenable to independent peer review because of the common NCSO practice to reference other CSEs for disposition of the contingencies.

The Team observed that each EUO CSR contains a separate section on firefighting requirements. General guidance for fire-fighting can be found in Y/DD-708, *Nuclear Criticality Safety Guidelines for Fire Fighting in the Y-12 Plant*. The Team found through discussions with the NCSO staff and reviewing the document that the document contained guidance for the fire department staff on recommended criticality safety firefighting practices.

The Team discussed treatment of natural phenomena in The CSA/CSR/CSE process with the NCSO staff. Historically, fire and flood conditions have been considered in the CSEs. Natural phenomena (earthquakes, floods, and fire effects) are evaluated in the SAR. The natural phenomena (flooding and seismic) effects are taken into consideration as the SARs are upgraded. As a result of the SAR Upgrade Program (SARUP) in Building 9720-5, the Team observed that storage racks had been removed where a wall might fall, and that conditions of storage in other racks had been revised due to possible flooding. The potential flood height in the plant was raised due to changes in DOE requirements for natural phenomena and this has required changes in storage practices at Y-12. LMES has an agreement with the local DOE office to consider seismic effects via the SARUP. The potential effects of fire and flooding have been and continue to be considered during the development of the CSE.

The Team observed tie-downs on containers, shelves, racks and carts. The Team was informed that these engineered controls were installed to mitigate the effects of seismic events. These and other controls will be evaluated during the SARUP. The Team concluded that the NCS practices relative to natural phenomena are appropriate and prudent for this stage of the SARUP.

The Team discussed the timeliness of CSR/CSA development with both NCSO and Operations Staffs. The CSRs for Phase A restart are produced in a timely fashion. Most CSR/CSEs for Phase A are developed without Process Descriptions because Operations did not have the resources to produce them. Plans are under way to provide Process Descriptions for Phase B activities. The Team discussed this issue with NCSO, Operations, Process Engineering staffs, and with Plant Management. All seem committed to providing Process Description for Phase B, but procedures and schedules were not in place during the quarterly review.

The Team was told that many revisions to CSRs are needed because the proposed operation changes or because the requirements are questioned as preparation for restart progresses. These revisions were observed to be in progress by the Team during the first quarter criticality safety program review. A senior engineer in NCSO reported to the Team that excessive time is taken to develop CSE/CSRs due to the procedure that requires a peer reviews for insignificant changes (spelling, etc.) and for the analyst having to chase down numerous individuals to get signatures for re-issue of revisions. The senior individual also reported that there is not enough time available to make good peer reviews. The Team could not validate this position, but found that the peer review process is not ensuring development of CSEs that document safety bases.

Strength

NCSO assigns Lead Criticality Engineers for each facility or process area, thereby improving NCSO *knowledge of operations and improving the NCS involvement with day-to-day Y-12 operations.*

The Team toured several facilities with DOE and Y-12 representatives. In each facility that the Team visited, an NCSO Lead Criticality Engineer accompanied the Team. The Lead Engineer was quite knowledgeable of the safety basis for the different processes. Operations management commented that the presence of the Lead Engineers in the facilities was very helpful. The Lead Engineers stated that their process knowledge had increased significantly since their assignments as Lead Engineers. Over time the presence of the Lead Engineer will minimize the development of inconsistent controls and limits between processes and will expedite contingency analysis.

4.0 Criticality Safety Review of Building 9206

Evaluation Criteria for Building 9206

Personnel are available to:

- Evaluate data pertinent to nuclear criticality safety (SRID 5317)
- Advise operations on NCS before new operations are begun or existing operations are changed. (SRID 5349)
- Review maintenance activities and facility modifications (SRID 5487)
- Ensure fissile materials are labeled, including pipes and tanks (SRID 5408)
- Ensure that the safety basis for the building includes the impact on criticality safety (SRID 5318)
- Review procedures and operations to ascertain compliance with existing CSEs. (SRID 10292)

Introduction

The objective of this element is to ensure that an active criticality safety program exists in Building 9206, even though most operations have been terminated and the facility is on stand-down with plans for decontamination and decommissioning. Material disposition of combustible wastes is tentatively scheduled via the 9206 Recovery Furnace through FY04 with deactivation complete by FY06 and storage mode termination in FY09. Transfer of stored material is to begin in FY99 as capabilities are brought online in Building 9212.

The Team toured the 9206 Building along with the Building Manager, lead criticality safety engineer, and the DOE Facility Representative. All personnel were very helpful in explaining the difficult problems associated with a facility undergoing deactivation. NCSO assigned a Lead Facility criticality engineer to 9206 who spends the majority of his time in the facility. Full-time criticality support for Building 9206 while restarting Building 9212 is a forward-looking approach to the ultimate transfer of the fissile material from 9206 to 9212.

Thirty-one active and twenty-one suspended CSAs cover Building 9206 operations. These include a combination of active CSAs, for in-use processing equipment, and suspended CSAs, for equipment/systems no longer needed, but still containing significant quantities of fissile material (i.e., greater than 350g of U-235). Some equipment was cleaned prior to the 1994 stand down. The CSAs for this equipment were canceled, and the equipment was taken out of service and tagged as abandoned in place. Other equipment, such as second cycle solvent extraction, was placed on standby with the columns still loaded with uranium solution.

Several shutdown legacies were noted that were not criticality issues, but reflected poor operating practices. These were: 1) secondary extraction column still loaded with organic and aqueous solution containing high concentration uranium; and 2) muffle pans of combusted process waste on a moveable cart with warped lids. The CSA covering muffle pans allows for sprinkler moderation such that no criticality concern exists. Radiologically, it is an open source of contamination that should be packaged appropriately.

The Team found that facility management placed an administrative hold on 9206 operations because of some discovered noncompliances with the CSAs. Only those activities explicitly reviewed by the Lead Facility criticality engineer are permitted. The Team observed that the lead criticality engineer for Building 9206 has caused some equipment; e.g., storage racks, to be taken out of service pending development of new CSEs. The equipment was posted with criticality safety deficiency notices and/or "Do Not Use" signs.

Weakness

The Building 9206 active and inactive criticality safety postings are not visibly distinguishable from each other.

The criticality safety postings in Building 9206 were similar to those found in DSO (see preceding discussion above). The facility criticality safety engineer reviews and replaces outdated CSAs and postings on a case-by-case basis. The task of issuing new CSAs and postings is complicated by the difficulty in locating old CSEs or the incomplete safety basis documented in old CSEs. The Team observed that the new approved postings in Building 9206 could not be distinguished from the old inactive postings. Building 9206 Operations Management should implement a method that visibly distinguishes postings that may be used from those that can't. The impact of this weakness on activities in the facility is mitigated by criticality safety involvement in every evolution. Hence, work is proceeding now at a slow enough pace and is controlled such that the potential for mistaking an inactive posting for an approved posting is low. However, as deactivation work intensifies this may not be the case and distinguishing the approved postings from the unapproved ones will enhance operations.

The Team discussed the use of temporary CSAs/CSEs with NCSO staff. Temporary CSAs are not being used. They are, however, being considered for use during the deactivation of Building 9206, a building that was placed in the stand-down mode in 1994. Processes will not be restarted for deactivation. Furnaces may be run to dry wet materials that are generated during deactivation. For such process activities, temporary CSA/CSRs may be produced. The review and approval process would be the same as for permanent CSA/CSA so that there is no significant change in the development of CSA/CSR for deactivation activities.

The Team concluded that the criticality safety risks in Building 9206 remain essentially unchanged from those identified in the High Enriched Uranium Vulnerability Report. The presence of the lead criticality engineer in the facility is a necessary but not sufficient step toward addressing the eventual criticality safety program needs for Building 9206.

CONCLUSIONS

Y-12 has made considerable progress in moving toward formal operations, notably with the inclusion of explicit criticality safety controls in operating procedures for both EUO and DSO. The Team identified an outstanding example of a PD/CSE/CSR set that demonstrates the process and procedures in place for EUO are capable of producing products meeting the expectation of ANSI/ANS Standards and DOE Orders if Y-12 Management commits to such an outcome. The Team also identified several program Strengths related to Procedures and Supervisory Responsibility.

The Team reviewed the *1998 Annual Review of the Y-12 Plant Criticality Safety Program*, and found it to be an excellent report. Based upon the Team's review of DSO, the Team concurs with all the findings, issues, noteworthy practices, and recommendations in the report. The Team found DSO operations are conducted safely from a criticality safety standpoint. Because of the safety of DSO operations and the inclusion of CSA controls and requirements in operating procedures, the process analysis upgrade recommended in the 1998 Annual Review Report should be undertaken only if Y-12 is committed to producing self-contained CSEs capable of independent review and verification. The Team judged that to accept anything less would not result in an enhanced safety posture commensurate with the cost of such an activity.

The Team found that Y-12 continues to place reliance upon its senior NCS staff with knowledge of the operating process and set of implicit controls to argue double contingency exists even though many of the CSEs are approved without containing this documentation. Prior reviews acknowledge the technical expertise resident in NCSO. The recent 1998 DSO NCS review identified a concern with the anticipated loss of these personnel through attrition, funding shortfalls, and retirements. The Team concludes that every operation restarted during Phase B should be supported by a stand-alone, fully documented criticality safety evaluation amenable to independent review and verification without resort to interviews of NCS staff. The Phase B CSEs and all future upgrades to CSAs and CSEs for Y-12 should "collapse the long chains of references, to document explicitly the assumptions used in the process analysis modeling, to provide the logic chain from underlying assumptions to the derived controls, and to identify the bases for specific requirements."

The Phase B operations involve aqueous processing. History has shown that fissile solution processing poses a greater risk of criticality than dry material operations. The hardware configuration of Building 9212 is complicated and interconnected. Experienced operators and NCSO staff are a scarce and declining resource. It is important to capture the criticality safety basis in self-contained CSEs to reduce the chance of missing key assumptions and controls by referencing old CSAs and to mitigate against loss of experienced personnel over the next twelve to twenty-four months. When CSEs become incomplete "cut-and-paste" approximations of the criticality safety basis and the second generation of CSEs selectively "cut-and-paste" from the first generation, criticality safety is compromised because the NCSO analysts will only have incomplete knowledge. In the near term, the Team is not convinced that process knowledge based upon recollections about the pre-1994 operating history is valid given the long stand-down and the loss of experienced personnel capable of running Building 9212. It is possible that new criticality scenarios have developed due to changes in the chemistry over time, changes in the hardware configuration, and different human failures. The Team concludes that reliance upon senior NCSO personnel having knowledge of the process to explain the safety basis of the system regardless of the deficiencies in the safety basis documentation sets the stage for a rapid degradation of operational criticality safety. The onset of this inevitable decay will be difficult to predict and more difficult and expensive to remediate. The Team developed a detailed recommendation to avoid this pitfall.

The criticality safety basis depends upon knowledge of the fissile material processes and systems. The Team noted that the finest example of a EUO CSE was supported by a PD complete with hardware description, process interfaces, and isolation points. For Phase B operations and all revised or modified operations, Y-12 Management should ensure that Operations (i.e. the SME, Process and System Engineers, EUO Restart and EUO Operations) Team with NCSO to develop PDs and CSEs/CSRs. Operations must be involved in defining the fissile processes, capturing the as-built configuration of the systems, identifying interfaces and boundaries, determining and verifying isolation points, and describing process upsets important to criticality safety in the PD. The Operations-NCSO Team should work together on the CSE to identify contingencies and develop controls for those contingencies that are acceptable to Operations. To avoid the problem of multiple revisions to recently issued CSRs, Operations should identify a SME (i.e. experienced operator who has run the process and is authorized to identify and accept criticality controls) to be part of the CSE/CSR development Team. It is the Team's experience that multiple rapid revisions to new CSRs results from ad-hoc Operations participation in the CSE development process that continuously changes the personnel interacting with NCSO most of which lack the proper overarching knowledge of the process and the authority to define and accept controls. Finally, Operations Management should read, understand, and concur on all CSEs. Criticality safety is a line management function. Development of impractical unusable Rev. 0 CSRs is the fault of Operations Management not NCSO. The CSE is Operations' criticality safety basis.

The Team reviewed the criticality safety posture of Building 9206. The Team found that the addition of a full-time criticality safety engineer in the facility is a positive development. Very little work is going on now in Building 9206. Deactivation activities have been planned and await funding and restart of the Phase B processes in Building 9212. Deactivation activities will require three to four full-time criticality engineers. The few evolutions that do occur in the facility receive criticality safety review. The Team noted one weakness in the criticality safety program related to the fact that new, approved postings are not visibly distinguishable from old, invalid criticality safety postings. The Team concluded that the criticality safety risks in Building 9206 remain unchanged from those identified in the HEU Vulnerability Report.

The Team recommends that YSO perform an additional independent criticality safety assessment of Phase B restart and Building 9206 deactivation activities. The review of Phase B should occur not later than the mid-point of the planned work schedule to permit mid-course corrections if needed. YSO should assess preparation for deactivation of Building 9206 by conducting an independent review of deactivation plans prior to initiating work. Such a review should be conducted when specific deactivation tasks are identified and a staffing plan is developed.

REFERENCES

These documents were made available to the Team, and were used to develop this report.

- 9206 Complex Phase Out/Deactivation Project Management Plan
- Alarm Response Procedure for Precipitator Wet Vacuum Tank/Trap
- ANSI/ANS-8.19, *Administrative Prac-tices for Nuclear Criticality Safety*
- Assessments of the Nuclear Criticality Safety Program at the Oak Ridge Y-12 Plant: A Comprehensive Review
- Basis for Interim Operation for Building 9212 Enriched Uranium Operation Complex (U)
- Basis of Safety for Solids in Building 9206 Extractor Column
- Building 9212 Facility Transition Plan for Building 9206 Deactivation
- CSA for Container Loading Limits (U)
- CSA for Empty Fissile Container and Equipment Storage

- CSA for Enriched Uranium Electropolisher (U)
- CSA for First Floor Cleaning Area Operations (U)
- CSA for Fissile Container Storage in VTRs (U)
- CSA for Fissile Work Station Ventilation Systems
- CSA for General Fissile Work Stations (U)
- CSA for Quality Evaluation Fissile Material Storage Arrays (U)
- CSA for Quality Evaluation Work Stations (U)
- CSA for SNM Vehicle Loading and Shipping (U)
- CSA for Special Nuclear Material Tube Vaults (U)
- CSA for Special Room Operations (U)
- CSA for Sub-Assembly Stripping (U)
- CSA for Temporary Storage of SNM in Trailers/Trucks
- CSA for Uranium Machining (U)
- CSA for Vacuum Can Loading (U)
- CSA for Walk-In Ventilation Hoods (U)
- CSA/CSR Suspension and Reactivation for Carbitol Phase Separator
- CSA/CSR Suspension and Reactivation for Denitrator Product (UO_3) Columns
- CSA/CSR Suspension and Reactivation for Dry Vacuum System
- CSA/CSR Suspension and Reactivation for Oxide Packaging – Denitrator Product
- CSA/CSR Suspension and Reactivation for Primary Extraction
- CSA/CSR Suspension and Reactivation for Primary Extraction – Carbitol Reservoir
- CSA/CSR Suspension and Reactivation for Primary Extraction – HNO_3 Makeup Tank
- CSA/CSR Suspension and Reactivation for Primary Extraction – Nitric Acid Supply Tanks.
- CSA/CSR Suspension and Reactivation for Primary Extraction – Raffinate Storage Tanks
- CSA/CSR Suspension and Reactivation for Process Condensate
- CSA/CSR Suspension and Reactivation for Secondary Extraction System
- CSA/CSR Suspension and Reactivation for Vent Scrubber
- CSE for Brookhaven Fuel Storage
- CSE for Chemical Area Storage
- CSE for Special Process Packaging and Sampling
- CSR and CSE for 9818 Tanks and Tankers
- CSR and CSE for AEC Exhaust System, C-Wing Scrubber
- CSR and CSE for Carbon Burners Room 1006
- CSR and CSE for Casting Operations (East and West Lines), Building 9212

- CSR and CSE for Containers and Material Handling
- CSR and CSE for Containers and Material Handling in 9212 and 9215
- CSR and CSE for E-Wing Metal Pickling Process in 9212
- CSR and CSE for Holden Gas Furnace Process, Room 29 Head House
- CSR and CSE for Muffle Furnaces Process, Headhouse Room 29
- CSR and CSE for M-Wing Machine Coolant
- CSR and CSE for M-Wing Machining Operations
- CSR and CSE for Room 1010 Special Processing Tube Furnaces
- CSR and CSE for Special Oxide Production Room 1010
- CSR and CSE for Topo Extraction C-1 Wing
- CSR and CSE for Westfalia Centrifuge, C-1 Wing
- CSR for Chemical Area Storage
- CSR for O-Wing Operations (U)
- CSR, CSE, Process Description, Operating Procedure (Precipitator and Centrifuge Operation), Process Drawings, System Operating Procedure
- DOE O 420.1, *Facility Safety* (included for information only)
- DOE Order 5480.24, *Nuclear Criticality Safety*
- DSO General NCS Requirements
- Example of Operational Review (OP Review) of Process Conditions for Building 9206
- Info Notes 97-003 through 98-010 – Includes the following:
  - 97-003, PBR Container Guidance
  - 97-004, PBR Liquid Accumulation Limit Guidance
  - 97-012, Technical Info: Subcritical Concentration Limits
  - 97-016, ANSI/ANS-8.5-1996 Re-view
  - 97-017, CSR Requirements for the Uranium Holdup Survey Program
  - 97-018, Criticality Safety Posting Guidance for CSR/CSAs
  - 97-019, CSE Format and Content Guidance (CSE/CSE Format 1)
  - 97-020, CSE Format and Content Guidance (CSRs and CSAs/CSE Format 2)
  - 97-027, CSE Approval Quick-Reference Guide
  - 97-028, CSA Format Guidance
  - 98-001, Rev. 0, EUO PBR Information Guidance
  - 98-002, Plexiglass Shields for Glass Columns and Tanks
  - 98-003, CSE Section Headings, Standard Statements, and Contents
  - 98-004, Rev. 0, Integration of CSEs and BIOs for EUO Facilities
  - 98-005, Rev. 0, Criticality Accident Alarm System Coverage Guidance

- 98-006, Rev. 0, ANSI/ANS-8.3-1997 Review
- 98-007, Rev. 0, Recommended Workstation Directory and Filename Structure
- 98-008, Rev. 0, ANSI/ANS-8.22-1997
- 98-009, Rev. 0, CSE Content Expectations
- 98-010, Rev. 0, Senior Technical Resource Group

- Interpretive guidance for DOE Order 5480.24 and ANSI/ANS-8 series of standards
- KENO Calculations to Support Brookhaven Fuel Storage Evaluation
- NCS Guidelines for Fire Fighting in the Y-12 Plant
- NCSO Info Notes 97-018, Criticality Safety Posting Guidance for CSRs
- NCSO ORR Preparation Guide
- Req. for CSA for 9201-5 Combustible Storage
- Req. for CSA for Assembly and Reassembly of Mock-ups and Trainers (U)
- Req. for CSA for Brookhaven Fuel Element Storage; Shipping and Receiving (U)
- Req. for CSA for Column Dissolver Solution Storage
- Req. for CSA for Contaminated Combustibles and Non-Combustibles
- Req. for CSA for Denitrator Feed Tank
- Req. for CSA for Disassembly Work Tables
- Req. for CSA for Empty Fissile Material Containers and Equipment Storage
- Req. for CSA for Fissile Container Storage (U)
- Req. for CSA for Fissile Material Container Loading Limits (U)
- Req. for CSA for Fissile Material Loading Limits (U)
- Req. for CSA for Floor Cleaning
- Req. for CSA for Gas Sampling Operations
- Req. for CSA for General Fissile Container Storage (U)
- Req. for CSA for Irregular Container Storage (U)
- Req. for CSA for Module Storage Vaults (MSV) (U)
- Req. for CSA for NDA standards Handling and Storage (U)
- Req. for CSA for Primary and Secondary Chambers of Uranium Recovery Furnace (URF)
- Req. for CSA for Primary Evaporator Feed Storage Tanks
- Req. for CSA for Room 30 Packaging Glovebox
- Req. for CSA for Safe Bottle Rack
- Req. for CSA for Safe Volume Fissile Material Vacuum Cleaners
- Req. for CSA for SNM Storage
- Req. for CSA for Storage and Loading Activities in Beta-2E Vault (U)

- Req. for CSA for Storage Array Room 30
- Req. for CSA for Storage of Reactor Fuels (U)
- Req. for CSA for Storage Racks
- Req. for CSA for Transfer and Storage of High Flux Isotope Reactor (HFIR) Fuel Elements (U)
- Req. for CSA for Transport and Storage of K-25 Alumina Traps
- Req. for CSA for UF_4 Can Storage
- RFA for approving compliance schedule as specified in 5480.24, section 7.a(1), and ANSI/ANS 8.7, 4.2.3
- Y-DD-430, Rev. 4, Quality Assurance Plan, Nuclear Criticality Safety Organization
- Y/DD-552, Revision 3, Oak Ridge Y-12 Plant Nuclear Criticality Safety Organization Self-Assessment Program, 8/26/97
- Y/DD-587, Rev. 35, Nuclear Criticality Organization List of Qualified Personnel, 9/30/98
- Y/DD-673, Management Plan for Assessing Y-12 Plant Criticality Accident Alarm System Coverage
- Y/DD-694, Qualification Program, Nuclear Criticality Safety Organization (NCSO), 5/19/97
- Y/DD-784, The Status of Natural Phenomena Issues Related to Nuclear Criticality Safety, August 14, 1997
- Y/DD-791, Assessment of Y-12 Plant Practices Governing the Relationship Between NCSO Double Contingency and Natural Phenomena Events Related in Authorization Basis Documentation, October 21, 1997
- Y/DD-796, Criticality Safety Improvement Self-Assessment of Non-EUO Facilities at the Y-12 Plant
- Y/DD-807, Methodology to Address Weaknesses Between NCS Analyses and Authorization Basis Document Events, January 22, 1998
- Y/DD-855, Management Plan for the Methodology to Upgrade Criticality Safety Evaluations Supporting the Disassembly and Storage Organization, 9/30/98
- Y/DW-1741, 1998 Annual Review of the Y-12 Plant Criticality Safety Program
- Y/MA-7270, EUO Material Handling Containers
- Y10-012, Hazard Identification Planning for Maintenance and New Work Tasks
- Y10-102, Technical Procedure Process Control, 4/8/98
- Y10-187, Integrated Safety and Change Control Process, 3/19/98
- Y10-37-036, Configuration Management – Change Control Process, 5/22/98
- Y15-001INS, Grading Criteria for Y-12 Facilities and Systems, 7/17/98
- Y15-203, Writer's Guide for Y-12 Plant Technical Procedures, 9/1/98
- Y-12 Plant Combustibles Disposition Plan
- Y50-01-37-051, Special Nuclear Materials Interplant Receipts (U)

- Y50-01-50-021, Brookhaven Element Storage and Handling
- Y50-01-50-031, Recontainerization of Units from Drum Type (DT) Shipping Containers (U)
- Y50-01-50-050, Special Nuclear Materials Interplant Shipments (U)
- Y70-01-150, General Nuclear Criticality Safety Requirements, 4/28/98
- Y70-150, Nuclear Criticality Safety Program, 2/9/98
- Y70-159, Fissile Material Activity Identification, Marking, and Requirements Posting, 4/27/98
- Y70-160, Criticality Safety Approval System, 11/10/97
- Y70-68-001, Criticality Safety Requirements Development, Review, and Approval, 11/10/97
- Y70-68-003, Nuclear Criticality Safety Incidents, Deficiencies, and Procedural Noncompliances, 8/30/96
- Y70-68-004, Criticality Safety Approval Development, Review, and Approval, 8/18/97
- Y70-68-005, Quality Assurance for Nuclear Criticality Safety Computer Calculations, 7/17/97
- Y70-68-007, Review of Documents Controlling Fissile Material Activities, 9/17/97
- Y70-37-102, Validation and Implementation of CSRs, 9/18/98

ACRONYMS

ANS	American Nuclear Society
ANSI	American National Standards Institute
BIO	Basis for Interim Operation
CCP	Change Control Process
CR	Change Request
CSA	Criticality Safety Approval
CSE	Criticality Safety Evaluation
CSR	Criticality Safety Requirement
DNFSB	Defense Nuclear Facilities Safety Board
DOE	Department of Energy
DSO	Disassembly and Storage Organization
EUO	Enriched Uranium Operations
FY	Fiscal Year
g	gram
LMES	Lockheed Martin Energy Systems, Inc.
NCS	Nuclear Criticality Safety
NCSO	Nuclear Criticality Safety Organization
OSB	Operational Safety Board
PD	Process Description
SAR	Safety Analysis Report
SAR	Safety Analysis Report Upgrade
SME	Subject Matter Expert
SRID	Standards/Requirement Identification Document
TOPO	Tri-*n*-Octyl Phosphine Oxide

USQD	Unreviewed Safety Question Determination
YSO	Y-12 Site Office

APPENDIX A: TECHNICAL REVIEW FORMS

APPENDIX B: REVIEW PLAN

September 28, 1998

PLAN FOR THE FIRST QUARTER CRITICALITY SAFETY PROGRAM REVIEW AT THE OAK RIDGE Y-12 PLANT

OFFICE OF NUCLEAR AND FACILITY SAFETY, EH-3
OFFICE OF ENVIRONMENT, SAFETY AND HEALTH
U.S. DEPARTMENT OF ENERGY

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Team Leader, Dr. Jerry N. McKamy Date
Office of Nuclear and Facility Safety
U.S. DOE Office of Environment, Safety and Health

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PLAN FOR THE FIRST QUARTER CRITICALITY SAFETY PROGRAM REVIEW AT THE OAK RIDGE Y-12 PLANT

PURPOSE

The purpose of this review is to support the Department of Energy's Y-12 Site Office (DOE YSO) first-quarter FY99 review of the criticality safety program at the Oak Ridge Y-12 plant. YSO management has two primary objectives in performing this focused review. First, the Team will review criticality safety evaluations to ensure the program meets the requirements of ANSI/ANS-8.19, *Administrative Practices for Nuclear Criticality Safety*, as well as related ANSI/ANS-8 series standards. Second, the Team will examine the criticality safety of operations in Building 9206 to ensure that safety is not degrading in this uranium solution storage and processing facility during the prolonged curtailment of operations. The safety of the processes in Building 9206 will be examined in light of requirements extracted from ANSI/ANS-8.1, *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors*.

BACKGROUND

Fissile material operations at the Y-12 plant are being restarted in phases after curtailment in 1994. Uranium processes such as shipping, inspection, assembly, disassembly, casting, and machining have been restarted. Operations remaining to be restarted involve uranium recovery and aqueous processing. The criticality safety program has been changing during each phase of restart in accordance with DOE approved restart plans with the goal of eventually meeting the requirements of the ANSI/ANS 8 Standards. This phased approach has resulted in different levels of compliance with the standards, and hence, different criticality safety programs, for each of the major process areas depending upon when the operation restarted. DOE YSO wants to ensure that the Y-12 criticality safety program is on the proper path toward meeting the safety requirements of the ANSI/ANS Standards, especially for the relatively higher risk solution processing operations expected to resume in FY99. An important aspect of this review will be to examine the disparities in the criticality safety practices applied to the different phases of operation and to assess the safety significance of these diverse practices. Finally, the aqueous processing operations in Building 9206 are not expected to resume. The facility criticality safety program has received little attention, and safety of the stored uranium solutions warrants review to ensure that changes are not occurring that degrades criticality safety. DOE YSO management requested the support of the Office of Nuclear and Facility Safety, EH-34, in performing this focused quarterly review to provide an independent review by respected criticality safety professionals.

REVIEW SCOPE

This review will encompass the elements of the criticality safety program dealing with the Double Contingency Principle and the criticality safety evaluations at Y-12. The applicable DOE Order at Y-12 for criticality safety is 5480.24. DOE Order 420.1, which replaced the older order, has not been incorporated into contracts with Lockheed Martin Energy Systems (LMES) which operates Y-12. DOE Order 5480.24 mandates compliance with certain ANSI/ANS Standards for criticality safety, including ANSI/ANS-8.1 and ANSI/ANS-8.19. The review areas were drawn from the mandatory Standards, ANSI/ANS-8.1, *Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors,* and ANSI/ANS-8.19, *Administrative Practices for Nuclear Criticality Safety,* and are categorized as follows:

- Supervisory Responsibilities - Line supervision accepts responsibility for the criticality safety of their operations; supervisors understand the controls, contingencies, and criticality safety basis for operations under their control; classroom and job-specific training in criticality safety is provided to personnel; procedures govern all work and there are effective change control and configuration control mechanisms; supervisors verify compliance with criticality safety specifications before authorizing work; and supervisors require conformance with good safety practices, good housekeeping, and unambiguous identification of fissile materials.

- Operating Procedures - Procedures are written and organized to facilitate operator use and understanding; procedures contain criticality controls; mechanisms are in place to facilitate revising and improving procedures on a periodic basis; new or revised procedures involving fissile material are reviewed by the nuclear criticality safety staff; procedures are supplemented by postings; postings are easily visible, understood by operators and contain clear, and contain all criticality controls implemented by the operator; deviations from procedures and processes and criticality infractions are investigated promptly, documented, reported to management, categorized according to approved procedures, and actions are identified to prevent recurrence; criticality infractions are resolved in a timely manner; and, operations are reviewed frequently (at least annually) to assure that processes and procedures have not been altered in a way so as to affect the applicable nuclear criticality safety evaluation.

- Process Evaluation for Nuclear Criticality Safety - All fissile material operations are analyzed to show that the processes will remain subcritical under all normal and credible abnormal conditions; the criticality safety evaluation is documented in a clear unambiguous manner; contingencies and controls are explicitly identified; calculational methods are properly validated; priority is placed on experimental data, handbook values, and bounding methods where applicable; engineered safety features are relied on to provide criticality safety to the extent practicable; procedures for producing criticality safety evaluations, limits, and postings are used; and criticality safety evaluations are independently peer reviewed before operations are authorized.

- Criticality Safety Review of Building 9206 – Management provides personnel skilled in the interpretation of data pertinent to nuclear criticality safety and familiar with operations to serve as advisor to supervision; before a new operation with fissionable materials is begun or before an existing operation is changed, it is determined that the entire process will be subcritical under both normal and credible abnormal conditions; operations to which nuclear criticality safety is pertinent are governed by written procedures; the movement of fissionable materials is controlled; appropriate materials labeling and area posting is maintained specifying material identification and all limits on parameters that are subjected to procedural control; deviations from procedures and unforeseen alterations in process conditions that affect nuclear criticality safety are reported to management and investigated promptly; operations are reviewed frequently (at least annually) to ascertain that procedures are being followed and that process conditions have not been altered so as to affect the nuclear criticality safety evaluation.

REVIEW REQUIREMENTS

1.0 SUPERVISORY RESPONSIBILITIES

Criterion: Each supervisor shall accept responsibility for the safety of operations under his control. (ANSI/ANS-8.19, Section 5.1) [S/RID 5329]

- Line supervisors accept responsibility for criticality safety of their operations. Is ownership demonstrated by the following: 1) approving criticality safety postings; 2) reviewing and approving criticality controls in procedures; 3) participating in the development of criticality safety evaluations; 4) providing input to the Nuclear Criticality Safety Staff for preparing postulated criticality scenarios; and 5) approving criticality safety evaluations for operations?

Criterion: Each supervisor shall be knowledgeable in those aspects of nuclear criticality safety relevant to operations under his control. Training and assistance should be obtained from the nuclear criticality safety staff. (ANSI/ANS-8.19, Section 5.2) [S/RID 5330]

- Are line supervisors familiar with the criticality accident scenarios in Criticality Safety Evaluations (CSEs) supporting their operations?
- Do line supervisors understand the underlying assumptions in CSEs that involve configuration of equipment, facility modifications, isotopic composition, etc.?
- Does the Nuclear Criticality Safety Staff provide training to line supervisors?
- Do the line supervisors have direct access to the Nuclear Criticality Safety Staff?
- Does line supervision know who the Nuclear Criticality Safety Staff is and how to contact them?
- Does line supervision know the safety basis for the criticality controls for their operations?

Criterion: Each supervisor shall provide training and shall require that the personnel under his supervision have an understanding of procedures and safety considerations such that they may be expected to perform their functions without undue risk. Records of training activities and verification of personnel understanding shall be maintained. (ANSI/ANS-8.19, Section 5.3) [S/RID 5331]

At a minimum, operators receive criticality safety training in accordance with ANSI/ANS-8.20, "Nuclear Criticality Safety Training."

- Do supervisors provide job specific training on procedures?
- Are walkthroughs and dry runs on procedures provided?
- Do pre-job briefs cover criticality controls specific to the operations at hand?
- Do plan-of-the-day meetings address criticality safety related topics like work restrictions due to criticality safety infractions, availability of new CSRs and postings, need for Nuclear Criticality Safety Staff participation, results of recent criticality safety assessment/surveillance, etc.?
- Do supervisors maintain training records for their personnel?
- Do supervisors ensure that their personnel are current in criticality safety classroom training?

- Are there required reading records or other evidence that personnel are knowledgeable of changes to procedures, Criticality Safety Requirements (CSRs), and Criticality Safety Approvals (CSAs) whichever is applicable?
- Do supervisors ensure that personnel have demonstrated an understanding of modified or revised procedures, CSRs, or CSAs prior to authorizing work?
- Are there records of job specific training on CSRs/CSAs?
- Do supervisors request assistance from the Nuclear Criticality Safety Staff to provide training for operations personnel?
- Do firefighters receive criticality safety training?
- Are firefighters aware of any moderator-controlled areas or processes?

Criterion: Supervisors shall develop or participate in the development of written procedures applicable to the operations under their control. Maintenance of these procedures to reflect changes in operation shall be a continuing supervisory responsibility. (ANSI/ANS-8.19, Section 5.4) [S/RID 5332]

- Are fissile material handling operations performed according to approved procedures?
- Are Process Descriptions available for all the processes prior to performing the criticality safety evaluation?
- Do Process Descriptions contain system descriptions, system boundaries, controls on process boundaries, and a discussion of credible process upsets?
- Are Process Descriptions developed for operations utilizing system walkdowns to verify as built/as found conditions?
- Do procedures incorporate all necessary criticality safety controls consistent with the CSR and CSE?
- Are operations personnel or supervision involved with developing procedures?
- Is there a mechanism to assure that only current, approved procedures, CSRs, CSEs, and/or CSAs are used for operations?
- Does a clear, unambiguous link between the CSE, CSR/CSA, and procedure exist such that it is traceable from floor level documentation?
- Is there a mechanism to ensure that OSR related controls and requirements in procedures or postings are not changed without proper analysis and approval?
- Are Unreviewed Safety Question Determinations made for all procedure modifications?

Criterion: Supervisors shall verify compliance with nuclear criticality safety specifications for new or modified equipment before its use. Verification may be based on inspection reports or other features of the quality control system. (ANSI/ANS-8.19, Section 5.5) [S/RID 5333]

- Are there procedures or mechanisms in place and effective to ensure that modifications to equipment and/or processes results in a review of the applicable CSE-CSR/CSA-procedure set prior to implementing the modification?
- Are there documented surveillance methods that ensure that new or modified operations conform to applicable CSEs-CSRs/CSAs?

- Is there a process for ensuring that no new or modified operation is started until all applicable verification steps have been performed which includes presence of approved CSEs, CSRs/CSAs, , and procedures and that no criticality infraction will result from startup?

Criterion: Each supervisor shall require conformance with good safety practices including unambiguous identification of fissile materials and good housekeeping. (ANSI/ANS-8.19, Section 5.6) [S/RID 5411]

- Are all fissile materials labeled as to quantity, chemical form, and isotopic composition?
- Are stored, empty containers labeled as such?
- Are gloveboxes with criticality drains free of loose debris that could potentially clog the drain?
- Is all fissile material stored in appropriate containers?
- Prior to beginning work at a workstation, is there a procedure to verify compliance with criticality safety requirements?
- Is there evidence of fissile material holdup or filings in gloveboxes?
- Are criticality drain liquid traps monitored for adequate liquid levels periodically?

2.0 OPERATING PROCEDURES

Criterion: The purpose of operating procedures is to facilitate the safe and efficient conduct of the operation. Procedures should be organized and presented for convenient use by operators. They should be free of extraneous material (ANSI/ANS-8.19, Section 7.1) [S/RID 5488]

- Are criticality controls in procedures clear, concise, free of criticality safety jargon, and easily identifiable?
- Is the criticality safety related information presented in procedures free of unnecessary detail and directly applicable to the job task being performed?
- Do the operators find the criticality safety related instructions easy to understand and follow?

Criterion: Procedures shall include those controls and limits significant to the nuclear criticality safety of the operation. (ANSI/ANS-8.19, Section 7.2) [S/RID 5489]

- Are criticality controls included in operating procedures?
- Are the criticality controls clearly identified as important to safety?
- Is there a clear, unambiguous, link between criticality controls in procedures and their parent CSR/CSA and CSE?
- Does LMES have a formalized process for determining which controls are incorporated in procedures?
- Does LMES have a formalized process for ensuring that controls in the CSE are implemented in procedures in a manner consistent with the intent of the CSE?
- Do pre-fire plans incorporate criticality safety controls?

Criterion: Supplementing and revising procedures, as improvements become desirable, shall be facilitated. (ANSI/ANS-8.19, Section 7.3) [S/RID 5490]

- Are procedures revised based on lessons learned to reduce occurrence of deviations and infractions?
- Do operators have a feedback process whereby improvements to procedures can be implemented?
- Are adequate resources available to facilitate procedure improvements as they are identified?
- Are procedure revisions timely?
- What change control mechanism is in place that assure only the current, approved procedures are utilized?

Criterion: Active procedures shall be reviewed periodically by supervision. (ANSI/ANS-8.19, Section 7.4) [S/RID 5491]

- Are procedures periodically reviewed?
- Do the Nuclear Criticality Safety Staff periodically participate in reviews of active operating procedures?
- What mechanisms are in place to ensure that all procedures are reviewed as planned?

Criterion: New or revised procedures impacting nuclear criticality safety shall be reviewed by the nuclear criticality safety staff. (ANSI/ANS-8.19, Section 7.5) [S/RID 5492]

- Do all new or revised procedures receive review by the NCS Staff?
- Does the NCS Staff review authorization basis documents (SAR, BIO, USQD, etc.)?
- Does the NCS Staff review configuration control procedures?

Criterion: Procedures should be supplemented by posted nuclear criticality safety limits or limits incorporated in operating check lists or flow sheets. (ANSI/ANS-8.19, Section 7.6) [S/RID 5412]

- Are criticality safety postings easy to understand by operators?
- Do the postings contain only information controlled by the operator performing the task?
- Do the postings require any analysis on the part of the operator such as decoding “IF-THEN”, “EITHER-OR” type options to select appropriate controls?
- What is the relationship between the controls in the posting and the controls in the procedures?
- Is there a formalized process for determining which controls appear on postings and which appear in procedures?
- What mechanism is in place to ensure that the controls in the posting are consistent with those intended by the parent CSE?
- Are postings easy to read from normal operator positions at the workstation?
- Do operators rely primarily on postings to obtain their criticality safety controls?
- Are the controls necessary for safety included in postings?

Criterion: Deviations from operating procedures and unforeseen alterations in process conditions that affect nuclear criticality safety shall be documented, reported to management, and investigated promptly. Action shall be taken to prevent a recurrence. (ANSI/ANS-8.19, Section 7.7) [S/RID 5340]

- Are potential infractions identified from deviations from postings alone, or is the CSE and procedure consulted before declaring an infraction has occurred?
- Is it possible to violate a posting and still be within the scope of controls imposed by the CSE?
- How are infractions graded?
- Are the contingencies and barriers for a given operation readily available when investigating potential infractions?
- Is provision made for management to upgrade the assigned severity level of infractions due to adverse trends?
- Is provision made for management to upgrade the assigned severity level of infractions due to the magnitude of the decrease in the margin of subcriticality?
- Do operators immediately stop work, leave the immediate vicinity, notify supervision, post the area, and contact the NCS staff promptly when a potential infraction is identified?
- Does the Nuclear Criticality Safety Staff respond to the scene of a potential infraction?
- Are the responsibilities of the Shift Technical Advisor (STA) and the NCS staff defined for responding to a potential infraction?
- Does the NCS staff participate in management critiques of infractions, assigning levels of infraction, and developing corrective actions?
- Are infractions resolved promptly and normal operations restarted?
- Are corrective actions stemming from criticality infractions entered into a tracking database and monitored until closure?
- Are minor (e.g. non-reportable) criticality infractions tracked and trended?
- Are all criticality infractions, regardless of severity, documented and shared among the NCS staff and operations?
- Does an independent safety review provide an appeal mechanism if infractions are under reported or downgraded inappropriately?

Criterion: Operations shall be reviewed frequently (at least annually) to ascertain that procedures are being followed and that process conditions have not been altered so as to affect the nuclear criticality safety evaluation. (ANSI/ANS-8.19, Section 7.8) [S/RID 10293]

- Are all operations audited at least annually?
- How do annual reviews determine that procedures are being followed?
- Do audits and reviews monitor the configuration of the facility and processes which could adversely affect criticality safety, such as movements of criticality detectors, installation of new equipment, inoperable emergency enunciators, etc.?
- Are procedures in place that verify that changes to process equipment over time have not degraded compliance with criticality safety controls?

- Prior to work being restarted in inactive equipment, is there a procedure for verifying that the equipment conforms to criticality safety requirements?
- Do annual reviews of operations look at all the elements of the criticality safety program affecting operations?

3.0 PROCESS EVALUATION FOR NUCLEAR CRITICALITY SAFETY

Criterion: Before starting a new operation with fissile materials or before an existing operation is changed, it shall be determined that the entire process will be subcritical under both normal and credible abnormal conditions. (ANSI/ANS-8.19, Section 8.1) [S/RID 5357]

Criticality safety evaluations shall conform to the requirements of ANSI/ANS-8.1, "Nuclear Criticality Safety in Operation with Fissionable Material Outside Reactors."

- Are natural phenomena hazards, especially seismic, considered in developing accident scenarios?
- Are firefighting scenarios considered (i.e. addition of moderator, displacement of fissile material in water streams, etc.)?
- Do the contingencies credited represent events that are at least unlikely?
- Are all credible process upsets considered and either controlled or dispositioned appropriately?
- Are the criticality safety evaluations produced in a timely fashion?
- Does LMES have formalized procedures for generating criticality safety evaluations?
- Does staff familiar with the facility and operations under consideration produce the criticality safety evaluations?
- Does the NCS staff take full advantage of simplifying methods, bounding calculations, critical experiment data, handbook data, etc. where appropriate to minimize dependence upon Monte Carlo techniques?
- Does the NCS staff members have access to all existing criticality safety evaluations as reference?
- Does criteria exist for determining the magnitude of process change which can be implemented without revising the criticality safety evaluation?
- Does the Nuclear Criticality Safety Staff work as a Team with operations and the restart organizations to develop credible accident scenarios and controls?

Criterion: The nuclear criticality safety evaluation shall determine and explicitly identify the controlled parameters and their associated limits upon which nuclear criticality safety depends. (ANSI/ANS-8.19, Section 8.2) [S/RID 5358]

- Are controls developed in the criticality safety evaluation for each contingency?
- Are controlled parameters, contingencies, and credited barriers explicitly documented?
- Does the criticality safety evaluation identify those controls that are to be included in procedures and those which should be included in postings?

Criterion: The nuclear criticality safety evaluation shall be documented with sufficient detail, clarity, and lack of ambiguity to allow independent judgment of results. (ANSI/ANS-8.19, Section 8.3) [S/RID 5342]

- Do the criticality safety evaluations conform to DOE-STD-3007-93, *Guidelines for Preparing Criticality Safety Evaluations at Department of Energy Non-Reactor Nuclear Facilities*?
- Are the CSEs stand-alone documents containing the information needed for an independent reviewer to judge its adequacy?
- Is there a change control and document control system in place for criticality safety evaluations?
- Are internal memoranda used to generate limits and controls in place of formal evaluations?
- Are temporary limits and evaluations (i.e. those that expire after a specified period) used?
- Are all assumptions fully documented in the criticality safety evaluation?
- Can the criticality safety evaluation be read and understood by line supervision?
- Do the CSEs contain descriptions of the fissile material process being analyzed?
- Do the CSEs utilize figures and diagrams to clarify the analysis?

Criterion: Before starting operation, there shall be an independent assessment that confirms the adequacy of the nuclear criticality safety evaluation. (ANSI/ANS-8.19, Section 8.4) [S/RID 5343]

- Do all criticality safety evaluations receive an independent technical peer review before approval for use?
- Is there a process for confirming that all credited engineered features of a system or process are in place and meet the specifications anticipated by the evaluation prior to starting operations?
- Is there a process for assuring that the criticality safety evaluation, CSRs/CSAs, and procedures are all consistent prior to starting operations?

4.0 CRITICALITY SAFETY OF BUILDING 9206

- **Criterion:** Management provides personnel skilled in the interpretation of data pertinent to nuclear criticality safety and familiar with operations to serve as advisor to supervision; before a new operation with fissionable materials is begun or before an existing operation is changed, it is determined that the entire process will be subcritical under both normal and credible abnormal conditions; operations to which nuclear criticality safety is pertinent are governed by written procedures; the movement of fissionable materials is controlled; appropriate materials labeling and area posting is maintained specifying material identification and all limits on parameters that are subjected to procedural control; deviations from procedures and unforseen alterations in process conditions that affect nuclear criticality safety are reported to management and investigated promptly; operations are reviewed frequently (at least annually) to ascertain that procedures are being followed and that process conditions have not been altered so as to affect the nuclear criticality safety evaluation. (ANSI/ANS-8.1) [S/RID 5317, 10292]

- Are nuclear criticality safety engineers are routinely involved with Building 9206. Do the NCS staff regularly tour the facility? Is the NCS organization funded to perform necessary assessments and evaluations?
- Are criticality safety evaluations and limits in place for all operations?
- Do the current criticality safety evaluations consider the effects of the prolonged stand-down of the facility?
- Are maintenance activities and facility modifications reviewed by the NCS staff before performing the activities?
- Are fissile materials labeled appropriately including solution in pipes and tanks?
- Has natural phenomena hazards been considered in the criticality safety evaluations for the facility?
- Are all infractions promptly reported, investigated and corrected with the involvement of the NCS staff?
- Are there periodic criticality safety reviews of the facility and processes to determine conformance with the criticality safety basis for the facility?

RESULTS

The review will be documented in a report to YSO management by October 30, 1998. The format for the report will be determined by DOE YSO to ensure consistency with previous YSO criticality safety assessments. The report will draw conclusions about the adequacy of the criticality safety program, identify deficiencies and needed corrective actions, and provide recommendations to improve the program.

RESOURCES

Dr. Jerry McKamy, Team Leader
Dr. Rowland Felt, Deputy Team Leader
Dr. Ron Knief
George Bidinger
Elaine Merchant

Review Topics and Lead Team Assignments:

1. Supervisory Responsibilities – Dr.Rowland Felt
2. Operating Procedures - Dr. Ron Knief
3. Process Evaluation for Nuclear Criticality Safety – George Bidinger
4. Criticality Safety of Building 9206 – Dr. Jerry McKamy
5. Project Support – Elaine Merchant

The specific elements the Team will review include the following.

a. Building 9212 Basis for Interim Operation (BIO)
b. LMES Criticality Safety Procedures
c. Criticality Safety Evaluations (CSEs)
d. Criticality Safety Requirements (CSRs)
e. Criticality Safety Approvals (CSAs)
f. Criticality Safety Postings
g. The EH High Enriched Uranium (HEU) Vulnerability Report
h. Operating Procedures
i. Process Descriptions (PDs)
j. Interviews with Nuclear Criticality Safety Staff and Management
k. Interviews with Operations Supervisors (PBR, EUO, Nuclear Operations)
l. Interviews with Operators
m. Facility Tours
n. Observation of Work Being Performed
o. Interviews with YSO Criticality Safety Staff and Management
p. Interviews with YSO Facility Representatives
q. Criticality Safety Infraction Reports
r. Defense Nuclear Facility Safety Board (DNFSB) Correspondence
s. Y-12 Restart Plans, Including Phase B
t. HEU Corrective Action Plans

u. Y-12 Criticality Safety Program Improvement Plans

SCHEDULE

September 14-25	Team Review Procedures, Criticality Safety Evaluations, Postings, etc.
September 28-October 2	Site Assessment
- Monday	Arrive, Badging, Tour 9212
- Tuesday	Tour 9215, Warehouse, Assembly, Disassembly
- Wednesday	Tour 9206, Begin Interviews
- Thursday	Team Interviews
- Friday	Complete Interviews
October 5-9	Team drafts report in Germantown
October 13-22	Team finalizes report and briefs ORO, YSO, and LMES Management

During the Site Assessment phase the Team Leader will brief YSO and LMES Management every morning on the Team's observations. The Team will provide observations and requests for information to YSO in writing on the forms included in this review plan. The "Form 2s" must be completed by the contractor, signed, and returned to the Team before the report can be issued. The Team will meet daily in the late afternoon to discuss observations and to finalize the schedule for the following day. When the final report to YSO is approved the Team will provide a briefing to YSO, ORO, and LMES management.

REVIEW FORM

Criticality Safety Program
Review Form

<table>
<tr><td>Review Area:
__ Management Responsibilities
__ Supervisory Responsibilities
__ Nuclear Criticality Safety Staff Responsibilities
__ Operating Procedures
__ Process Evaluation for Nuclear Criticality Safety
__ Materials Control
__ Planned Response to Nuclear Criticality Accidents</td><td>Form No.____________

Date:________________</td></tr>
<tr><td colspan="2">1. Identification Section:

A. Observation (including overall significance and basis):

B. References:

C. Information Requested (list of information needed to complete this form)</td></tr>
<tr><td colspan="2">2. Reviewers' Signature Section:

Originator ___________________________________ Date: ________________

Approved ___________________________________ Date: ________________</td></tr>
<tr><td colspan="2">3. Contractor Response (Provide basis and references):</td></tr>
</table>

Criticality Safety Program
Review Form

Review Area:	
__ Management Responsibilities __ Supervisory Responsibilities __ Nuclear Criticality Safety Staff Responsibilities __ Operating Procedures __ Process Evaluation for Nuclear Criticality Safety __ Materials Control __ Planned Response to Nuclear Criticality Accidents	Form No.____________ Date:________________
4. Contractor Signature Section:	
Contractor Originator: ________________________________	Date: _____________
Contractor Approval: ________________________________	Date: _____________

BIOGRAPHIES

Dr. Jerry N. McKamy – Dr. McKamy currently holds the position of Nuclear Criticality Safety Specialist in the Office of Engineering Assistance and Site Interface, EH-34, with the Department of Energy (DOE). Dr. McKamy received his Ph.D. in experimental nuclear physics from The Ohio State University (1982) and a BS in physics from the University of Texas at Arlington (1976). Dr. McKamy's areas of expertise include nuclear criticality safety and non-destructive assay. He started his nuclear career at the Critical Mass Laboratory at Rocky Flats in 1983. From 1983 through 1987 he performed critical experiments, validated Monte Carlo criticality safety codes, and was the responsible criticality safety engineer for various Rocky Flats production buildings. In 1987, Dr. McKamy joined the Safeguards Measurements Group as the Principal Engineer for neutron non-destructive assay. In 1989 as Manager of Safeguards Measurements, Dr. McKamy led the development and implementation of the Rocky Flat's non-destructive assay program to measure the plutonium holdup in the ventilation ducting. Late in 1990, Dr. McKamy returned to the Criticality Engineering Group at Rocky Flats as Manager. His major accomplishment as Manager of Criticality Engineering was instituting a formalized, standards-based, criticality safety program which was foundational to the successful Resumption of Operations in Buildings 559 and 707. In 1994, Dr. McKamy joined the consulting firm of M.H. Chew and Associates (CAI) where he primarily provided criticality safety support to the DOE Rocky Flats Field Office. In addition, he developed the criticality safety design criteria for the BNFL Team's Plutonium Stabilization and Packaging System and helped in the resolution of the Hanford TWRS Criticality Safety Question. Since joining EH-34 in the fall of 1996, Dr. McKamy has been actively assisting DOE Field Offices at Rocky Flats, Y-12, Richland, and Lawrence Livermore National Laboratory in the area of criticality safety. Dr. McKamy is the EH member of the Nuclear Criticality Safety Program Management Team and the Criticality Safety Support Group responsible for leading the Department's criticality safety program developed in response to Defense Nuclear Facilities Safety Board Recommendation 97-2. Dr. McKamy is the chair of the American Nuclear Society Nuclear Criticality Safety Division Education Committee and serves on the International Technical Program Committee for the 1999 International Conference on Nuclear Criticality Safety in Versailles, France.

Rowland E. Felt received his Ph.D. in Chemical Engineering from Iowa State University in 1964. His initial R&D experience was with General Electric Co. at Hanford developing plutonium processes. His development of extinguishing methods for plutonium metal fires led to his participation in the investigation of the Rocky Flats fire in 1969. For the next ten years, Dr. Felt developed the safety analyses on storage facilities at Hanford in addition to managing the process engineering functions at the chemical processing facilities at Hanford. In 1978, he moved to Exxon Nuclear Co., where he was Process Engineering & Development Manager for 9 years in the nuclear fuel fabrication facility in Richland, Washington. He moved to the Idaho National Engineering Laboratory in 1987 to develop the flowsheet and design the equipment for the SIS Project to separate plutonium isotopes using lasers. Preparation of the SIS Project environmental impact statement also utilized his plutonium facility and safety experience. In 1990 Dr. Felt spent two years at Savannah River supporting the Planning Support Group for

DOE nuclear materials management. This assignment led to the development of proposed discard criteria for plutonium waste. Return to the INEL continued his support of operational readiness reviews for DOE of plutonium facilities at Rocky Flats, Savannah River and Hanford. For the last four years, he was been a member of a Team of DOE scientists working with the Russians on radiochemical safety. More recently he participated in DOE's plutonium and high-enriched uranium vulnerability assessments. As a DOE nuclear material safety specialist, Dr. Felt? s primary responsibility is to provide technical support to the DOE complex.

George H. Bidinger – Mr. Bidinger is an independent consultant from Rockville, Md. He holds a Masters degree in physics from John Carroll University. As a consultant, Mr. Bidinger has provided safety evaluations and/or peer reviews for the Portsmouth Gaseous Diffusion Plant, the Babcock & Wilcox Naval Nuclear Fuel Division, the Atomic Energy Control Board of Canada, and the Defense Nuclear Facilities Safety Board at the Rocky Flats and Savannah River sites. He has conducted or participated in audits and assessments at Babcock and Wilcox, at USEC's Paducah and Portsmouth Gaseous Diffusion Plants, the K-25 plant, and the Y-12 plant for MMES and LMES. Mr. Bidinger has supported the Nuclear Regulatory Commission and Agency for International Development program by providing regulatory capability training to the Russians for the licensing and regulation of fuel fabrication and certification of gaseous diffusion plants.

Mr. Bidinger is retired from the U.S. Nuclear Regulatory Commission (NRC), and its predecessor the U. S. Atomic Energy Commission (AEC), where he served in supervisory, inspection, and engineering analysis positions. Prior to retiring from the AEC/NRC, he provided NCS engineering analyses for enrichment and fuel fabrication facilities, conducted NCS inspections and assessments, and supervised the environmental, chemical, radiation safety, NCS, and fire safety engineers preparing safety evaluation reports to support licensing actions for all commercial and naval-reactor fuel fabricators. Previously he worked as a criticality supervisor for the nuclear fuel operations of the Coors Porcelain Company and as a criticality safety specialist for the Rocky Flats Plant. Mr. Bidinger is a former Chair and an active member of the American Nuclear Society's Nuclear Criticality Safety Division. Mr. Bidinger has also helped organize ANS topical and international conferences on nuclear criticality safety. He served as NRC representative to the ANS N-16 consensus committee for ANSI/ANS-8-series Standards; he continues as an individual of N16. He also has been a member of several ANS-8 writing groups for these Standards programs. He has served as a faculty member for the University of New Mexico's Nuclear Criticality Safety Short Course since 1977 and the University's Workshop for Managers in Nuclear Criticality Safety in Albuquerque, Oak Ridge and Denver since 1994.

Dr. Ronald A. Knief – Dr. Knief is a Principal Consultant with Ogden Environmental and Energy Services, is a specialist in nuclear-criticality, -fuel-facility and -reactor safety; safety, environmental-compliance and management-system evaluation; risk management; and associated performance-based training. Prior to 1990, he spent ten years at the Three Mile Island Nuclear Station serving in training management and safety & risk management positions and six years on the faculty of chemical and nuclear engineering at the University of New Mexico. Dr. Knief holds a B.A. degree physics, mathematics and economics from Albion College and a Ph.D.

in nuclear engineering from the University of Illinois at Urbana-Champaign. He is a fellow of the American Nuclear Society, Vice Chair of N16 Consensus Committee for ANSI/ANS-8 Standards, Past Chair of the Nuclear Criticality Safety Division, and Recipient of 1985 Nuclear Criticality Safety Division Achievement Award.

Dr. Knief has conducted many detailed on-site nuclear criticality safety assessments of nuclear criticality safety activities and programs for nonreactor nuclear facilities. The most recent client has been the U.S. Department of Energy's Oak Ridge Operations Office as participant on the multi-disciplinary Team helping the DOE develop the compliance plan for the Paducah (KY) and Portsmouth (OH) Gaseous Diffusion Plants (GDP) to meet the U.S. Nuclear Regulatory Commission (NRC) certification requirements. Specific activities included serving as observer for DOE of NRC Assessment Team Visits and performing compliance-plan-issue close-out evaluations at both of the sites. Assessments have been performed for DOE M&O Contractors at the Oak Ridge Y-12 Plant, Oak Ridge National Laboratory, the Mound Plant, Savannah River Site, Fernald, the Waste Isolation Pilot Plant (WIPP), and Argonne National Laboratory. Assessments of USNRC Licensee facilities have been performed at General Electric Nuclear Fuels, Nuclear Fuels Services, Battelle-Columbus, Babcock & Wilcox (Naval Nuclear Fuel Division, Apollo, and Parks Township Facilities), and Westinghouse Cheswick.

Dr. Knief has developed and conducted training and education on nuclear criticality safety for NCS engineers and for management, supervisory, and engineering personnel. Thirty (30) professional development courses have been offered in conjunction with the University of New Mexico, on-campus and at the Oak Ridge Y-12 Plant, Rocky Flats Environmental Technology Site, and British Nuclear Fuels. Separate courses have been tailored to the needs of USDOE's Albuquerque and Oak Ridge Operations Offices, respectively, and the Westinghouse Hanford Company. He is also lead instructor for the "Nuclear Criticality Safety Training for Fuel Facility Inspectors" course taught four times for NRC staff and for regulatory and nuclear-facility personnel in Moscow, Russia and Kiev, Ukraine. Dr. Knief is author of *Nuclear Criticality Safety -- Theory and Practice*, the only textbook on the subject, published by the American Nuclear Society and of *Nuclear Engineering -- Theory and Technology of Commercial Nuclear Power*.

Elaine W. Merchant is a Senior Specialist with Parallax, Inc., working at Department of Energy (DOE) Headquarters for the Office of Engineering Assistance and Site Interface, EH-34. Ms. Merchant has over six years of experience working for DOE contractors. She worked at Lawrence Livermore National Laboratory (LLNL), first as a subcontractor, then as the lead Administrative Specialist from 1992 to early 1998, and was instrumental in establishing LLNL's Washington Operations Office. While at LLNL, Ms. Merchant worked with the DOE Offices of Nuclear Energy (NE), Nonproliferation and National Security (NN), and Defense Programs. One of her most significant accomplishments lay in six years of dedicated program support for the establishment of the Highly Enriched Uranium (HEU) Transparency Implementation Program, which facilitates the purchase of Russian weapons-grade uranium by DOE for blending into reactor-grade uranium. While her primary responsibilities lay in various administrative duties, Ms. Merchant served as the lead for specialized support needs such as multiplatform computer software assistance, graphics support, financial recordkeeping, and local Laboratory procurements, and as the backup to the technical editor. She has also worked for Argonne National Laboratory in Germantown, MD. Prior to supporting DOE through contractors, Ms. Merchant worked for Merrill Lynch for twelve years in accounting.